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METALS *and* ALLOYS

The Magazine of Metallurgical Engineering

PRODUCTION • FABRICATION • TREATMENT • APPLICATION

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Highlights

WRITTEN BY THE ABSTRACT SECTION EDITORS AND THE EDITORIAL STAFF

Do you want to know what metallurgical engineers are saying, the world over? Look in the Current Metallurgical Abstracts. Here are some of the points covered by authors whose articles are abstracted in this issue.

Light on Corrosion Problems

Potential measurements seem to throw light on corrosion problems, with Burns and Haring (page MA 42 R 1), Yamamoto (page MA 41 R 6) and Bannister and Rigby (page MA 4 1 R 4) all reporting on them.—H.W.G.

Some Job for a Dentist

Humphrey (page MA 43 L 9) tells dentists to become familiar with the literature on working and welding of 18-8. No wonder modern dental courses include some metallurgy, for what a fine task he'd have in reading the literature without it. We trust the article itself will absolve the dentist from reading all the literature.—H.W.G.

A Metallurgical Encyclopedia!

Hatfield must be a regular metallurgical encyclopedia. He tells all about aircraft steels in one article (page MA 43 R 2) and ship steels in another (page MA 43 L 7).—H.W.G.

Leaky Castings

According to *Giesserei,* (page MA 45 L 2) it is good German practice to soak leaky castings in urine to rust up the porous spots. Must keep the inspectors busy when the foundry runs into trouble. But of course plenty of beer will help.—H.W.G.

Electrode Potentials

Electrode potentials have long been the bugbear of corrosion "experts." They easily differentiate between the corrosion resistance of say, ordinary steel and stainless steel but when you attempt to use them to differentiate between ordinary steel and a low alloyed steel under a particular condition, e.g., atmospheric, they are not so hot. Now, our very able scientists, Burns and Haring (page MA 42 R 1) advocate using them for determining the efficiency of paint coatings. More power to them! It is well worth study. May we suggest that a comprehensive investigation of electrode potentials with the definite idea of using them for forecasting the behavior of metals and alloys, both ferrous and non-ferrous, under all conditions would pay dividends?—V.V.K.

Side-Lights on German and Russian Matters

Three abstracts in juxtaposition (page MA 45, L 8, L 9 and L 10) contain interesting side-lights on German and Russian affairs, economic as well as metallurgical.—H.W.G.

A Surprise!

We have mixed emotions about published metallurgical work of the present day; they seem to rdiscover and print so much that has been long known and many times printed. However, we have to give them credit for telling just what's in a trade-named product like "Lunkerite" when they study it (page MA 8 R 1).—H.W.G.

Relief of Casting Stresses

Machin and Oldham (page MA 7 R 5) report that you have to go to 1200 deg. F. for 2 hrs. for relief of casting stresses in cast iron.—H.W.G.

Another Name for a Crook

Nonorthogonality (page MA 31 L 2), according to our dictionary, is being not quite upright or perpendicular. Must remember that next time we don't want to say right out that a guy is crooked.—H.W.G.

Correct—After a Long Period

According to Fink and Smith (page MA 32 L 2) the precipitation hardening theory of Merica, Waltenberg and Scott demands no modification or complication. Not so bad to have hit a thing like that right the first time and have it held still right after so long and so much further thought on it.—H.W.G.

To Protect or Not to Protect Pipe Lines

Out of the mass of information from many tests on protected pipe lines has come the suggestion that the better method is to bury the pipe bare and then recondition or protect the pipe line *after* the "hot spots" have developed. At last we have a direct comparison of the validity of such a suggestion. Three pipe-line companies in 1917 each laid an 8-in. line in northern Texas and southern Oklahoma. Co. No. 1 did not protect; Cos. No. 2 and 3 used asphalt and saturated felt. After 18 yrs. the lines were taken up. Co. No. 1 could salvage 64 per cent of its pipe and Cos. No. 2 and 3, 93.5 per cent (page MA 41 R 2). How about making a corrosion survey before the pipe is laid and then protect in accordance with the results of that survey?—V.V.K.

Competition for Admiralty Metal

A. H. Moody (page MA 41 R 8) says that aluminum bronze and aluminum brass (95-5 Cu-Al; 75-22.5-2.5 Cu-Zn-Al) are much better for steam condenser tubes.—V.V.K.

Cavitation

To produce cavitation, Schwarz and Mantel find that a pressure maximum of about 30,000 atmospheres but of short duration and small energy content must occur (page MA 41 R 10)—V.V.K.

X-Raying Welds

Forker (page MA 23 L 9) remarks that X-ray examination of welds does not necessarily insure against poor properties, not only because of lack of sensitivity to small flaws but also because it gives no evidence of change in microstructure.—H.W.G.

Headlines

A title that tells the story, (page MA 23 R 1) is "Six Miles of Six Feet Steel pipe"; and others, "Prosit" (page MA 23 R 2) and "Welding Goes Fishing" (page MA 23 R 3) are expressive too.—H.W.G.

More About 4140

Doubling the ductility as well as increasing the tensile strength of 4140 by isothermal transformation as compared with quenching and drawing, is reported by Kantor and Radzievskaia (page MA 32 L 4).—H.W.G.

Welding Design

Welding is used extensively today in the fabrication of engineering structures. However, there still exists a decided lack of knowledge among engineers concerning the fundamental factors governing a satisfactory welding design. Furthermore, designers disagree as to the proper methods of calculating weld stresses and the correct working stresses to employ for different types of welded joints.

A number of variables, such as the selection of the best type of joint, the calculation of weld stresses, allowable working stresses and factors of safety, and physical characteristics of parent and weld metals enter into the problem. Consideration must be given also to various design features that are essential for satisfactory and economical welded structures. The latter include choice of materials, joint design, welding procedures, elimination of distortion, and similar items.

Obviously, before engineers and designers can make full use of the many advantages which welded construction affords, they must be furnished with complete and authoritative information on welding design. They must familiarize themselves with the various types of welded-joint designs and the corresponding recommended formulae for calculating the stresses in each. Tables of recommended working stresses for bare and coated electrode welds subjected to all types of loading must be made available to designers.

Therefore, any sound treatise on welding design (MA 23 L 7) which assists engineers and designers and furnishes them with additional worthwhile data undoubtedly is most acceptable and appreciated.—E.V.D.

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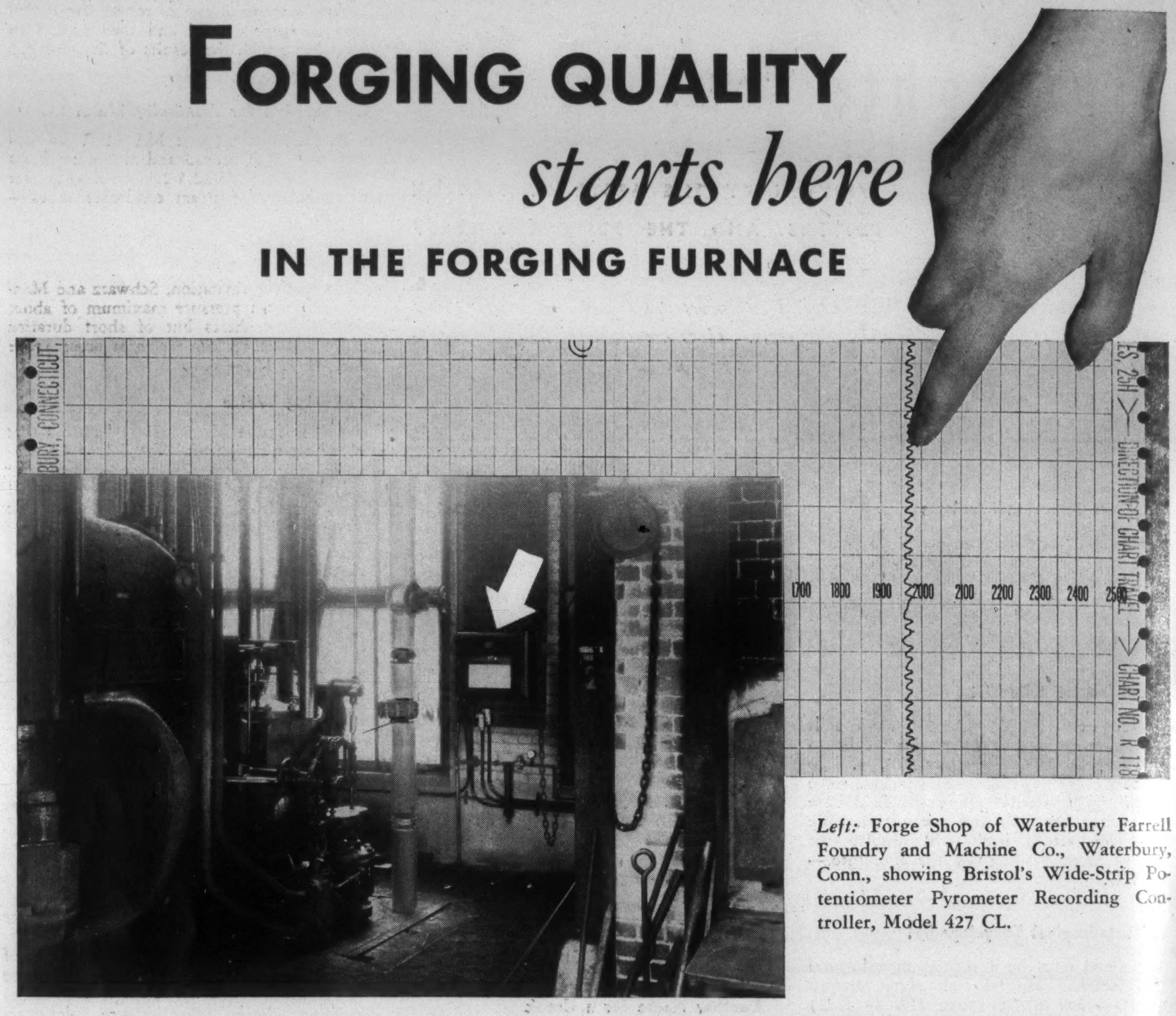

Left: Forge Shop of Waterbury Farrell Foundry and Machine Co., Waterbury, Conn., showing Bristol's Wide-Strip Potentiometer Pyrometer Recording Controller, Model 427 CL.

Waterbury Farrell Foundry and Machine Co. find Bristol's automatic temperature control promotes better forgings, saves fuel

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EDITORIAL

An Addition to our Editorial Staff

An assistant editor has been added to the editorial staff of METALS AND ALLOYS. Fred P. Peters joined the organization late in December and brings to his new connection a keen interest and experience in technical journalism and a combination of chemical and metallurgical knowledge and proved writing ability.

Mr. Peters was graduated in 1925 from the East Orange (N. J.) high school and took post graduate work for one year until he was of sufficient age (17) to enter Worcester Polytechnic Institute. For three and a half years he majored in chemistry at that institution. In June this year, by pursuing evening courses, he will obtain his B.S. degree at the Newark College of Engineering.

After varied chemical and metallurgical experience during the summers of 1926 to 1930, Mr. Peters entered the employ of Wilbur B. Driver Co., Newark, N. J., manufacturer of nickel-chromium wire and alloys, as chemist and metallurgist, in May, 1931, which position he held until his new editorial connection. At Newark regular analytical chemical work was supplemented with plant and metallurgical research and also technical publicity.

Within the last two years Mr. Peters has devoted much of his spare time to writing with the result that twelve articles and papers have been produced, nine of which have been published and two accepted for future publication. Among those published may be mentioned: "Electrical Resistance Alloys: Why Ni-Cr So Successfully Serves As A Heating Element Material," presented before the Washington meeting of The Electrochemical Society, October, 1935; "Rapid Determination of Nickel in 18 and 8 and in Other High Chromium Steels and Alloys," METALS AND ALLOYS, October, 1935; four articles in various issues in *Chemist-Analyst;* and others in *Product Engineering, Metallurgia, Electrical Manufacturing* and so on. Mr. Peters is also an abstractor of English, German and French periodicals for *Ceramic Abstracts* and METALS AND ALLOYS.—Editors

Low-Alloy, High-Elastic Steels

Concentrated interest was aroused less than a year ago in the development, particularly by several steel companies, of a series of low-alloy, high-elastic steels. Reviews of these developments, published early in 1936, showed that there were 15 such steels originating with steel companies and about 13 developed earlier by others, mainly the alloying metal producers. Since then there has appeared, in competitive commercial applications, one other steel sold by the second largest steel producing company in the country. No publicity has been given to this steel which is the Mayari class. Since the introduction of these steels to industry there have been many diversified and interesting applications. The importance of these is expanding rapidly. Originally the more recent steels were introduced as weight saving material in the building of freight cars, to say nothing of certain claimed anti-corrosive properties. Their welding characteristics have been also emphasized. Supplementing the application of these steels in both the freight and passenger car industry, there has developed their incorporation in other equipment. Prominent among these may be mentioned trucks, street cars, buses, tanks, frames for Diesel engines, hulls for ships, grab buckets, gun carriages, and so on. Some of the earlier steels were and are used in bridges.

Undoubtedly the tendency in the greater use of this type of steels is rapidly broadening. Saving weight in the carrying load with no sacrifice of strength, and probably with some increase, together with other advantages is being more extensively recognized. The whole development is one of those more or less simple ones which it is surprising had not gained its present wide recognition earlier. It was significantly stated last February by Gillett in his paper before the Mining Engineers, "Trends in the Metallurgy of Low-Alloy, High-Yield-Strength Structural Steels," that "it is not too strong a statement to conclude that, with the commercial advent of the high-yield steels, a new epoch of structural steel has been entered upon. It would not be surprising if these steels were to become the regular tonnage structural steels and that present-day carbon structural will be obtainable—should anyone need it—only upon special order."

This semi-prophesy is rapidly nearing fulfillment. Undoubtedly these steels will gradually find other applications than those already referred to, together with the expansion of present uses.—E. F. C.

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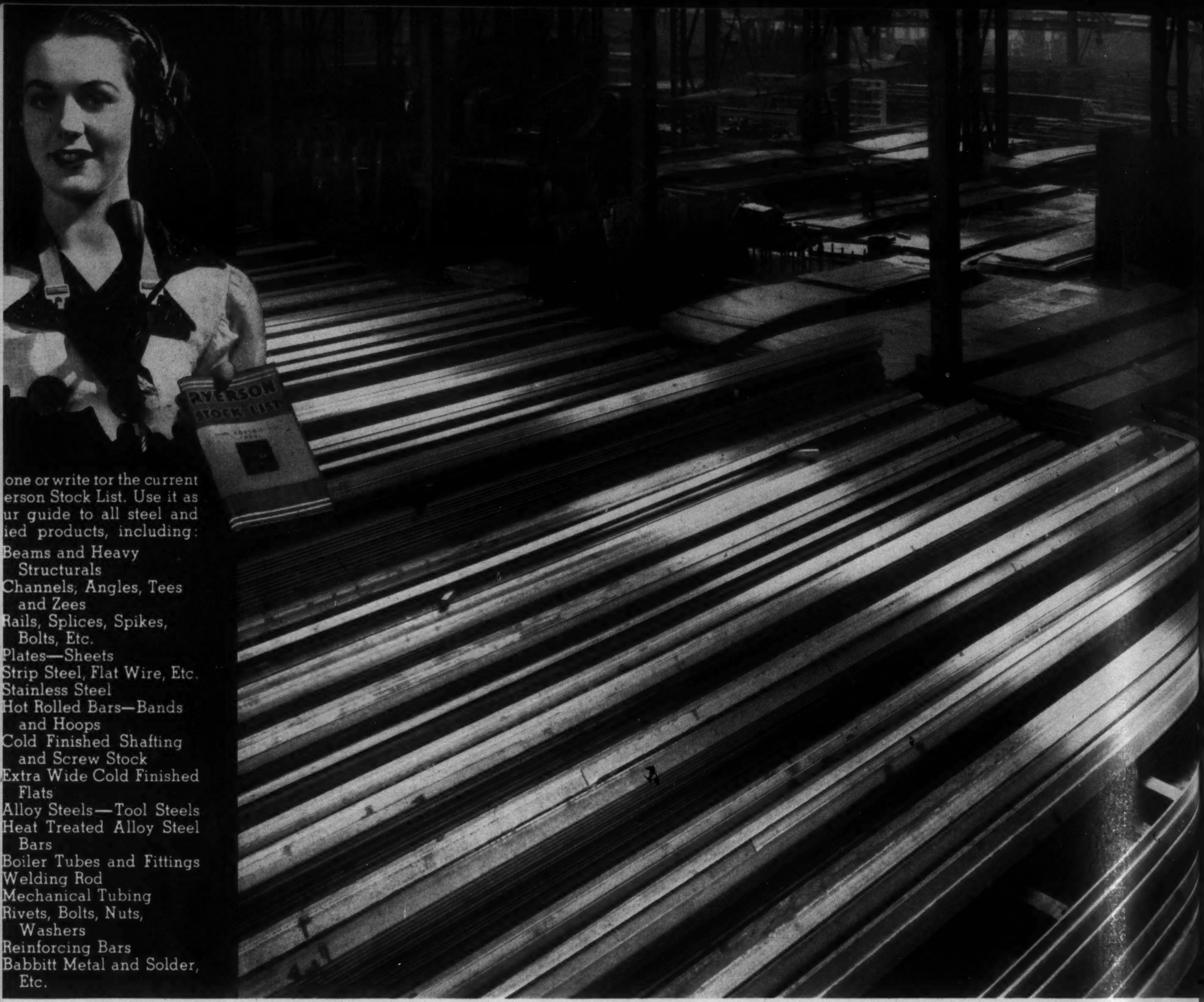
Erratum

In the article by Prof. H. F. Moore, entitled "How and When Does a Fatigue Crack Start?" published in the November, 1936, issue of METALS AND ALLOYS, there is an error in the diagram on page 298. For the points used in locating the probable damage line (solid circles and half-solid circles) the arrows should be placed on the points below and to the left of the probable damage line and there should be no arrows above and to the right of the damage line. This error was in the original diagram submitted by Professor Moore.



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CURRENT Metallurgical Abstracts

A DIGEST OF THE IMPORTANT METALLURGICAL DEVELOPMENTS OF THE WORLD

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CLASSIFICATIONS

1. ORE CONCENTRATION

Crushing, Grinding & Plant Handling (1a), Gravity Concentration (1b), Flotation (1c), Magnetic Separation (1d), Amalgamation, Cyanidation & Leaching (1e).

2. ORE REDUCTION

Non-Ferrous (2a), Ferrous (2b).

3. MELTING, REFINING AND CASTING

Non-Ferrous (3a), Ferrous (3b).

4. WORKING

Rolling (4a), Forging & Extruding (4b), Cold Working, including Shearing, Punching, Drawing & Stamping (4c), Machining (4d).

5. HEAT TREATMENT

Annealing (5a), Hardening, Quenching & Drawing (5b), Aging (5c), Malleableizing (5d), Carburizing (5e), Nitriding (5f).

6. FURNACES, REFRACTORIES AND FUELS

7. JOINING

Soldering & Brazing (7a), Welding & Cutting (7b), Riveting (7c).

8. FINISHING

Pickling (8a), Cleaning, including Sand Blasting (8b), Polishing & Grinding (8c), Electroplating (8d), Metallic Coatings other than Electroplating (8e), Non-Metallic Coatings (f).

9. TESTING

Inspection & Defects, including X-Ray Inspection (9a), Physical & Mechanical Testing (9b), Fatigue Testing (9c), Magnetic Testing (9d), Spectrography (9e).

10. METALLOGRAPHY

11. PROPERTIES OF METALS AND ALLOYS

Non-Ferrous (11a), Ferrous (11b).

12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

13. CORROSION AND WEAR

14. APPLICATION OF METALS AND ALLOYS

Non-Ferrous (14a), Ferrous (14b).

15. GENERAL

Economic (15a), Historical (15b).

1. ORE CONCENTRATION

JOHN ATTWOOD, SECTION EDITOR

Sampling Methods at the Tacoma Smelter. PAUL T. BENSON. *Mining & Metallurgy,* Vol. 17, Mar. 1936, pages 141-145. From a paper read before the North Pacific section, American Institute of Mining Engineers. Describes methods used by the American Smelting & Refining Co. A few general principles applying to sampling all types of ores are: They must be crushed enough to be reasonably uniform; sampling machinery must be correct; and mills must be cleaened upon completion of a lot. Size of lots or individual parcels for settlement depends on value of their contents. Sampling of bulk concentrate is carefully controlled. VSP (1)

Study of Composition of Kusa Sinters Reduced at Different Temperatures. A. E. MALAKHOV. *Metallurg,* No. 2, 1936, pages 88-91. In Russian. Mineralogical study. No data regarding sintering practice are given. (1)

1c. Flotation

The Effect of the Concentration of Hydrogen Ion and the Addition of Various Chemicals on the Flotation of Sphalerite. GAICHI YAMADA & KIYOJI NAGANUMA. *Suiyokwai-Shi,* Vol. 9, July 1936, pages 47-56. Budo sphalerite was finely crushed to 65 mesh and the 200 mesh powder was removed. The experiments on the flotation of sphalerite were carried out in solutions of various pH applying a given amount of flotation reagents, i.e., camphor white oil, potassium ethyl xanthate and adding a small amount of chemicals, e.g., $KMnO_4$, $K_2Cr_2O_7$, $CuSO_4.5H_2O$, $ZnSO_4.7H_2O$, tannin, KCN, NaCl. The floatability of sphalerite is from 98 to 99%, in the acid solution of 5.5-7.5 pH, and it suddenly decreases from 98 to 10% in the alkali solution of pH-value higher than 7.6. In the flotation experiments, on adding 500 g. $K_2Cr_2O_7$/ton of ore in solutions of various pH-values, the floatability of sphalerite suddenly decreases from 96 to 2% in the acid solution of pH-value higher than 5.45 and is only about 5% in alkali solution. In the case of 500 g. of tannin/ton of ore, sphalerite does not float at all in the solution of pH-value higher than 5.25. 100 g. $KMnO_4$/ton of ore suddenly depresses the floatability to 1%. But for 500 g. of $CuSo_4 5H_2O$/ton of ore, the floatability is constantly kept 99.5% in the range of pH-value from 1.3 to 11.65. It is found that the effect of adding $ZnSo_4.7H_2O$ or KCN is small and the floatability is not affected in NaCl solution. HN (1c)

Coagulation Solves Flotation Problem—Research Work at Maude and Yellow Mine. HECTOR J. HARRISON. *Chemical Engineering & Mining Review,* Vol. 28, May 8, 1936, pages 261-264. In the presence of ethyl-xanthate, aluminum sulphate effects a rapid coagulation of the slime. A eucalyptus oil containing a high percentage of eucalyptol makes the best frothing agent. The treatment plant is described and a flowsheet shown. WHB (1c)

1e. Amalgamation, Cyanidation & Leaching

Gold Bearing Deposits with Low Gold Content at Kilo-Moto, Belgian Congo (Les gisements aurifères à faible teneur de Kilo-Moto, au Congo Belge) J. DIGUÉ. *Génie Civil,* Vol. 108, Mar. 28, 1936, pages 293-297. Considerable profit was realized from these deposits though their Au content averaged only 0.484 g./m.^{3} Cyanidation could not be applied on account of local conditions. Amalgamation after fine grinding was entirely satisfactory. JDG (1e)

Gold Amalgamation. M. G. FLEMING. *Canadian Mining Journal,* Vol. 57, June 1936, pages 255-261. The variables within control of the operator the readjustment of any one of which may bring increaesed efficiency, are listed, as are fundamental requirements for plate, amalgamation, the reasons why immersion contact is less successful than grinding or surface contact, amalgamation, and the causes for failure to recover all of the Au by amalgamation. A bibliography is included. WHB (1e)

2. ORE REDUCTION

A. H. EMERY, SECTION EDITOR

2a. Non-Ferrous

Electrolytic Manganese—Its Potentialities Loom. J. KOSTER & S. M. SHELTON. *Engineering & Mining Journal,* Vol. 137, Oct. 1936, pages 510-512, 514. Mn of 99.6-99.80% purity was produced experimentally by continuous electrolytic deposition from domestic ores using commercial-quality reagents. Tables show (1) operating data on a typical run, (2) analyses of Mn ores used, (3) analyses of leach liquors, and (4) X-ray data. WHB (2a)

Electrolytic Production of Calcium. V. M. GUSKOV & M. T. KOVALENKO. *Metallurg,* Vol. 11, Aug. 1936, pages 73-76. In Russian. Anhydrous $CaCl_2$ was produced by fusing its dihydrate at 900° C. in Brace's apparatus with about 5% NH_4Cl until the water was eliminated and the mass completely fused, using 25 parts of the fused $CaCl_2$ and 4 parts of CaF_2 as the electrolyte. Current efficiency was 65-81.5%. (2a)

The Production of Aluminum by the Seailles Process (A Fabricacao da Alumina pelo Processo Seailles) J. C. SEAILLES. *Revista Brasileira de Chimica,* Vol. 2, Aug. 1936, pages 82-83 The process consists in dissolving in water lime aluminates which were obtained by boiling properly mixed aluminous minerals and calcium carbonates between 1000° and 1500° C. By treating the solution woth CO_2 an anhydrous Al_2O_3 and pure $CaCO_3$ are obtained. The practical advantages of this process are explained. The paper is written in Portuguese and French. Ha (2a)

Electrolysis of Magnesium Chloride. A. YU. TAITZ. *Legkie Metallui,* Vol. 5, Apr. 1936, pages 19-21. In Russian. Carnallite was electrolyzed in a cell without diaphragms using a distance between electrodes of 2 to 6 cm. and a current density of 0.5 to 2.0 amps./cm.^{2} A current efficiency of 81-85% was obtained with a consumption of 15.4 to 18.8 kw. hr./kg. of Mg. HWR (2a)

2b. Ferrous

Five Years of Progress in Southern Blast-furnace Practice. FRANCIS H. CROCKARD. *Transactions American Institute of Mining & Metallurgical Engineers,* Vol. 120, *Iron & Steel Division,* 1936, pages 36-56. Includes discussion. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 439L/1. (2b)

The Production of Iron in Norway, Modern Progress in Electric Smelting. HERMAN CHRISTIANSEN. *Metals & Alloys,* Vol. 7, Sept. 1936, pages 225-228. Describes the history of Fe smelting particularly in Norway. The development of electric smelting is discussed. Various furnaces are described. The latest types employ coke as a reducing agent and produce pig Fe of closely controlled composition. WLC (2b)

Addition of Ores to Acid Converters to Increase their Output. A. DUDAR. *Stal,* Vol. 6, Feb. 1936, pages 26-36. In Russian. The addition of ores to high Si heats is discussed. HWR (2b)

Production and Preparation of Blast-Furnace Flux. P. C. HODGES. *Transactions American Institute of Mining & Metallurgical Engineers,* Vol. 120, Iron & Steel Division, 1936, pages 121-133. Includes discussion. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 439L/3. (2b)

Relative Desulfurizing Powers of Blast-furnace Slags. W. F. HOLBROOK & T. L. JOSEPH. *Transactions American Institute of Mining & Metallurgical Engineers,* Vol. 120, *Iron & Steel Division,* 1936, pages 99-120. Includes discussion. See *Metals & Alloys,* Vol. 7, July 1936, page MA 339R/7. (2b)

Recovery of Blast-furnace Flue Dust from Scrubber Water. T. B. COUNSELMAN. *Metals Technology,* Sept. 1936, *American Institute Mining & Metallurgical Engineers Technical Publication* No. 743, 11 pages. Various installations for the clarification of scrubber water are described. Settling tanks and tray thickeners are both used. The best practice is to filter the sludge obtained. The cake can be charged directly to the blast furnace, but it is better to agglomerate by nodulizing or sintering. JLG (2b)

3. MELTING, REFINING AND CASTING

Mould and Core Sand Mixtures at Elevated Temperatures. Composition and its Effect upon Properties. F. Hudson. *Metal Industry,* London, Vol. 48, June 12, 1936, pages 652-659, 671; *Engineer,* Vol. 162, Sept. 4, 1936, pages 241-244. Paper presented at the Annual Conference of the Institute of British Foundrymen at Glasgow, June 10. The author gives the results of his investigation and indicates possible methods of controlling the properties of these sands at high temperatures. (The portion of the paper dealing with steel foundry sands is not included in this article. This paper is a continuation of the work reported in the *Foundry Trade Journal* of Dec. 5, 1935. See *Metals & Alloys,* Vol. 7, Apr. 1936, page MA 176.) The author states that high temperature properties of most green sands are superior to those of dry sand and loam. He has endeavored to show the effect of additions of reasonable amounts of several carbonaceous materials to both mold and core materials so that better properties are obtained at the higher temperature encountered during casting. Additions were made of up to 10% of both coal dust and saw dust. The effect of each of these materials on the sand at atmospheric temperature and at elevated temperatures are indicated. It was found that additions of saw dust imparted better properties to the sand than did coal dust. In an appendix to the article the effect of clay additions upon the properties of soil sand at elevated temperature is discussed. HBG + VSP (3)

Bibliography on the Fluidity and Viscosity of Metals. *Iron & Steel Institute Bibliographical Series* No. 1, Sept. 1936, 11 pages. An annotated bibliography of 60 references covering the period 1902 to 1935. JLG (3)

Use of Cements for Bonding of Sands for Foundry Purposes (Ueber die Verwendung von Zementen als Bindemittel bei Sanden für Giessereizwecke) M. Paschke, C. Weymann & E. Schneider. *Giesserei,* Vol. 23, July 31, 1936, pages 381-386. Cement-sand mixtures were investigated with regard to their suitability in molding for foundry purposes, and it was found that they can be used to great advantage. The permeability for gas is very good, mechanical strength excellent, and they are sufficiently fire-resistant. They can be used over again after comminution and adding some new cement. The sand should be as sharp as possible and free of harmful impurities. The tests and a method for determining permeability to gas are described. Ha (3)

Castability of Metals and Alloys (Die Vergiessbarkeit von Metallen und Legierungen) W. Patterson. *Giesserei,* Vol. 23, Aug. 14, 1936, pages 405-410. The results of investigations relating to the "castability" of metals and alloys are reviewed and the castability test by Saito & Hayashi is described. The length of a rod formed when the metal runs out from a definite form under definite conditions is used to determine this property. Pure metals, intermetallic compounds and eutectics, all of which are characterized by a distinct melting point, possess good castability. Conditions of crystal formation, solidification interval and their effect on castability are discussed. Ha (3)

Points of View in Using Scrap in the Aluminum Foundry (Gesichtspunkte bei der Verwendung von Abfällen in der Aluminium-Giesserei) R. Irmann. *Aluminium,* Vol. 18, Sept. 1936, pages 416-421. Mixing Al scrap for remelting is discussed exhaustively taking into consideration requirements of the finished casting for mechanical, chemical and physical properties. Mixed Al scrap should be separated into (1) scrap which could be melted together with other scrap in any ratio, (2) scrap which should be melted in a certain ratio only, and (3) scrap which must not be melted together with other scrap. A number of (German) standard Al alloys are tabulated with their composition and the percentage permissible in a charge for some of the more common scraps determined. Ha (3)

Cooling of Ingots in Molds. I. E. Gorshkov. *Metallurg,* Vol. 11, Aug. 1936, pages 104-110. In Russian. When flat ingot molds are filled with metal, expansion caused by non-uniform heating causes ingot walls to curve outward at the ends. Their center remains in contact with the hot metal resulting in the maximum cooling in this area. Many defects can be explained on this basis. (3)

3b. Ferrous

C. H. HERTY, SECTION EDITOR

Contraction. W. Machin & M. Oldham. *Foundry Trade Journal,* Vol. 54, Apr. 30, 1936, pages 343-348. Paper read before the Scottish branch of the Institute of British Foundrymen. All cast metals are subject to the laws governing expansion and contraction. Castings of irregular section may break due to a sudden release of high stresses produced during contraction from the plastic condition to the solid. In connection with the subject of strains an investigation was carried out by the authors on a wheel which was made in dry sand mold and cast from metal containing T.C., 3.35; F.C., 2.75; C.C., 0.78; Mn, 0.51; Si, 1.78; S, 0.11; P, 0.39%. The stress in the spoke was determined to be 6.01 tons/in.^{2} To determine the correct heat-treatment temperature to eliminate or reduce such strains a number of test-bars were cast at the same time the wheel was cast. One of these bars was used for a load deflection test set up in a special apparatus. The elastic limit in transverse was found to be 15.7 tons/in.^{2} This stress corresponded to a deflection of 0.013". The bars were then given a deflection of 0.008" corresponding to an induced stress of 10.5 tons/in.^{2} The bars still held in the apparatus were then individually heated to progressively increasing temperatures and the elastic deflection remaining was measured. Each bar was maintained at these temperatures for 2 hrs., after which it was slowly cooled in the furnace. It was found that a temperature of 650° C. was necessary before the stress was completely removed. Similar experiments with steel wheels and test bars indicated complete strain relief after heat-treatment at 650° C. AIK (3b)

Developments in the Foundry Industry During Recent Years. J. E. Hurst. *Metallurgia,* Vol. 14, June 1936, pages 37-38. A brief review. JLG (3b)

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Teeming Steel with Lunkerite. *Kachestvennaia Stal,* Vol. 4, No. 6, page 55. In Russian. Lunkerite used contained 28% Al powder, 5% Fe-Si (45% grade), 25% charcoal, 30% fire clay, 12% bauxite ground to pass 3 mm. sieve. Added to hot tops the composition reduced croppage due to shrinkage cavity to 12%. (3b)

Ford Engine Parts are cast from Alloy Iron and Steel. *Steel,* Vol. 98, Apr. 13, 1936, pages 53-54, 56. See "Ford Casts Parts of Alloy Iron and Steel," *Metals & Alloys,* Vol. 7, Aug. 1936, page MA 398R/2. MS (3b)

Cast-Iron Pipes. W. Woodhouse. *Foundry Trade Journal,* Vol. 54, May 7, 1936, pages 357-362. Lecture given to the Sheffield branch of the Institute of British Foundrymen. Metal pipes were first used by the Romans, who made water mains of sheet Pb folded into tubular form and soldered at the edges. Cast Fe pipes were first manufactured over 250 years ago. Many of the original pipes are still in service. Vertical pit casting, the Ardelt process, body cores, socket cores, centrifugally-spun cast pipes, impact testing machine, coating, etc., are discussed. In discussing centrifugally-spun cast pipes the author points out that the rapid solidification of the metal causes the formation of a fine crystalline structure in which the graphite is evenly distributed in a very fine form. Centrifugal action prevents the formation of blowholes or other cavities in the section of the casting, any gases formed being expelled by this action. All tests prove that the spun pipe is in all instances equal or superior, despite its reduced thickness, to sand-cast pipes. AIK (3b)

Basic-Bessemer Plant, Corby (England) (Das Thomas-Stahlwerk Corby (England)) F. Lilge. *Mitteilungen aus den Forschungsanstalten des GHH-Konzerns,* Vol. 4, May 1936, pages 147-156. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 442R/4. Ha (3b)

Modeling in the Foundry. T. W. Lippert. *Iron Age,* Vol. 137, June 18, 1936, pages 26-29, 98, 99. Describes method used by the American Manganese Steel Co. Small scale models were made of a large casting giving considerable trouble in service. Models were cast under different methods of gating and risering conditions. These models were radiographed. A perfect casting was finally produced and it was found that the yield of metal was increased and founding practice simplified. VSP (3b)

New Spun Plant for Cast-Iron Pipes. *Foundry Trade Journal,* Vol. 54, June 25, 1936, pages 506-508, 510. The Mairy process, charging arrangements, the spinners, normalizing furnace, reheating furnace, etc., are discussed. The Mairy process consists of applying a thin coating of ferro-silicon in the revolving steel mold before the metal is introduced. This deposition forms an insulating surface on the mold, and prevents the formation of chill. The resulting casting combines the high tensile strength of the original de Lavaud pipe with a greatly increased ductile strength and resistance to shock. A fracture of the pipe discloses a 2-zone structure, the outer zone consisting of closely-interlocked dendrites in multi-directional resistance, and an inner zone having a characteristic centrifugal structure with finely-dispersed graphite, producing high tensile strength. It is claimed that the pipes now made by the improved process possess greater ductility and strength than any cast-Fe pipes previously produced. Paper is illustrated with a number of photographs. AIK (3b)

Comments on the Manufacture of Special Cast Iron in the Cupola (Réflexion sur la Fabrication des Fontes spéciales au Cubilot) A. Guedras. *Revue de Fonderie Moderne,* Vol. 30, May 10, 1936, pages 153-156. Methods used at present to produce cast Fe for special purposes by alloying with Ni, Cr, Al, effect of Mn and Si content and desulphurization methods are briefly reviewed. Ha (3b)

Designers of Steel Castings Should Co-operate with Foundrymen. Clarence B. Harbison. *Steel,* Vol. 98, June 22, 1936, pages 54, 56. Foundryman can often suggest slight changes in design that will improve molding conditions by providing for better gating and feeding. There should be a gradual decrease in thickness of sections from cope to drag. Concentration of metal can be avoided by staggering ribs and webs; by providing openings in webs and ribs where they join body of casting; and by not using large radii at inside of corners and small radii at outside. Large, flat, thin plate members should be avoided. Thick corners require use of cracking brackets to prevent cracking or of chills to equalize cooling. Gradual blending of thick section into surrounding thin metal sometimes helps to avoid difficulties arising from use of heavy chills. Bosses should be blended gradually into body of casting to avoid stress concentrations. Metal should be distributed along force lines. Castings should be designed so that cores can be supported by printing through, thus avoiding use of chaplets. Endurance value of steel should be carefully considered. MS (3b)

The Manufacture and Utilization of Electric Steel in the Foundry. T. R. WALKER & C. J. DADSWELL. *Foundry Trade Journal,* Vol. 54, Feb. 20, 1936, pages 157-160. Paper before Sheffield branch of Institute of British Foundrymen. The fluidity, "castability" or running life of electric steel is not entirely governed by the temperature. In some cases the steel may be extremely hot, but at the same time sluggish and difficult to run. The most troublesome steel, as far as the occurrence of gas holes is concerned, is a steel containing about 0.35 to 0.4% C. One suggestion for the explanation of the formation of gas holes, especially in green-sand molds, has been put forward by Lemoine, who maintains that if the turnings used in the furnace charge are wet, the moisture present, on being heated to the temperature of the electric furnace, dissociates into O and H dissolving in the liquid steel. If the charge is given an adequate boil, any H dissolved in the bath will be removed, rendering pin-hole formation less likely. A theory very different from the above has recently been advanced that blowholes are due to non-metallic inclusions. The envelope of steel solidifies at a much higher temperature than the inclusions, and it is suggested that at some time during this period a small amount of mold gas is able to enter the casting by the way of the still liquid inclusions. AIK (3b)

Methods for Making Hadfield Steel in Basic Open Hearth Furnaces. P. V. UMRIKHIN & K. S. MALOTZKI. *Kachestvennaia Stal,* Vol. 4, No. 5, 1936, pages 49-51. In Russian. Hadfield steels can be made in open hearth furnaces either by reduction of slag after Mn addition or by adding reducing materials simultaneously with Mn additions. In the first instance, a mixture of 50% Al powder and 50% CaO is added to the slag which begins to thicken after Mn addition. This leads to reduction of other oxides requiring a thorough dephosphorization in the previous stages of the process and a thorough slag skimming. The second method was illustrated by a number of heats made in a 5 ton furnace (melting sheet is given). It consists in adding Mn in portions, together with Fe-Si sufficient to reduce the oxides formed. This permits working with normal slags, reduces Mn oxidation to about 14% and furnishes sound steel containing about 0.5% Si. (3b)

Melting in a Cupola Using Oxygen Addition to the Blast. V. K. TZELIKOV. *Liteinoe Delo,* Vol. 7, No. 6, 1936, pages 39-40. In Russian. Description of experiments in which the blast was oxygenated in order to bring up the temperature of the metal. The desired results were easily obtained, but the metal was inferior due to wrong composition of the charge. (3b)

Steel Refining in the Induction Furnace (Afino de acero en el horno de induccion) C. TAMA. *Metalurgia y Construccion Mecanica,* Vol. 2, Aug. 1936, page 5; Sept. 1936, page 4. Points out the advantages of the induction furnace and discusses briefly the following items: the atmosphere in the furnace, refractories, refining procedure, oxidation and other reactions taking place, and finally the economical aspect. FRM (3b)

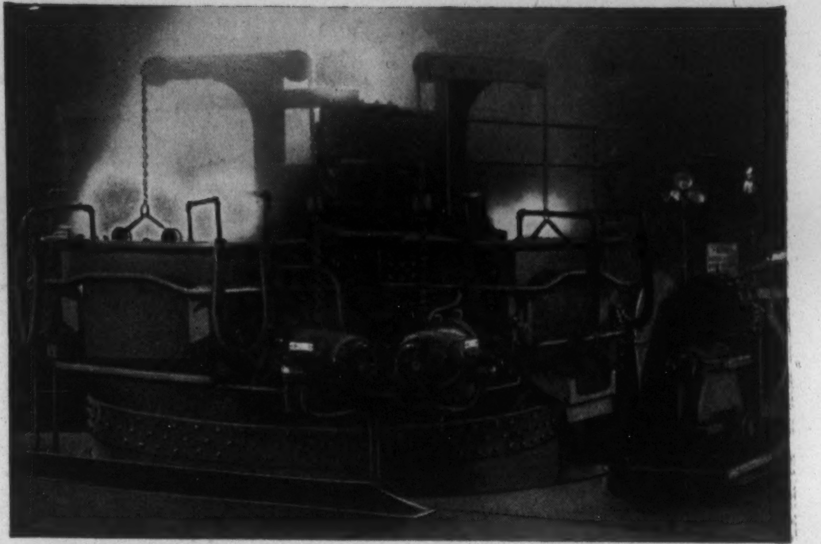
Molding of a Pulley of a Different Length from that of the Pattern (Moulage d'une Poulie de Largeur différente du Modele) C. SEQUERT. *Revue de Fonderie Moderne,* Vol. 30, Apr. 25, 1936, pages 141-142. Describes molding procedure. Ha (3b)

Methods of Estimating Cupola Mixtures. E. C. ROLLASON. *Metallurgia,* Vol. 14, June 1936, pages 49-52. Methods of making up charges are given which are applicable to normal practice, and which will assist in providing fluid Fe of suitable composition. JLG (3b)

Rapid Metallurgical Reactions by Slags (Réactions Métallurgiques Rapides par les Laitiers) PERRIN. *Usine,* Vol. 45 June 4, 1936, page 25. The effect of temperature, chemical composition of the slag, contact surface and time of contact, on the production of steel is briefly discussed. Time needed for deoxidation and dephosphorization as function of contact surface of added deoxidizers is shown in curves. Ha (3b)

Influence of Teeming Conditions on Hairline Formation in Chromium Nickel Steels. A. M. PELEVIN & B. KH. SAPIR. *Kachestvennaia Stal,* Vol. 4, No. 6, 1936, pages 51-52. In Russian. Results of plant practice show that amount of hair lines is inversely proportional to the size of ingot molds. Bottom casting reduces their size and amount. (3b)

Heat Losses in Thomas Converter during Course of a Campaign (Die Wärmeverluste der Thomasbirne im Verlauf einer Konverterreise) M. PASCHKE & E. PEETZ. *Stahl und Eisen,* Vol. 56, Jan. 23, 1936, pages 86-93. Heat losses through the shell and mouth of a 30-ton converter were determined during 300 melts in a campaign. See also *Metals & Alloys,* Vol. 7, Aug. 1936, page MA 398R/6. SE (3b)



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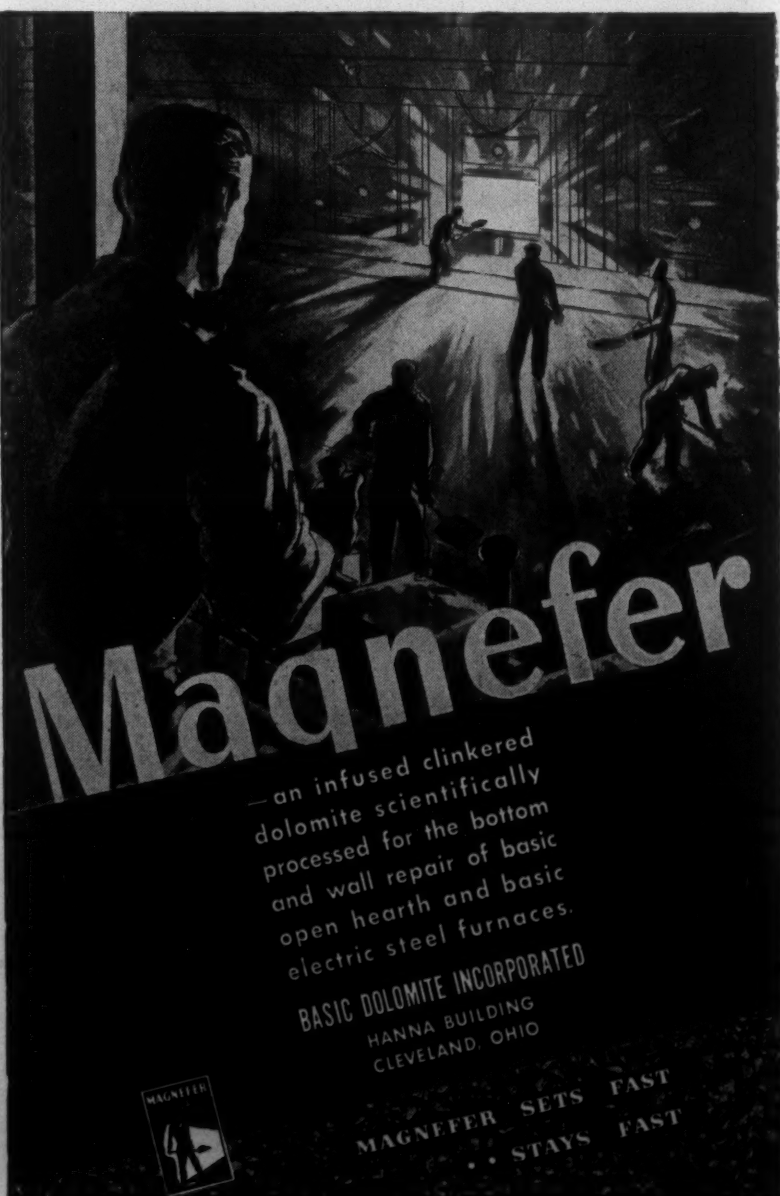
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Technological Aspects of Steel Making using Kussa Titanomagnetite Irons. E. M. Karlik & G. V. Savel'ev. *Kachestvennaia Stal,* Vol. 4, No. 4, 1936, pages 37-42. In Russian. Methods for utilization of V contained in irons can be divided into 2 groups, complete oxidation of V in slag with subsequent recovery of the metal, or partial oxidation of V into slag and partial retention in the steel produced. Process, as conducted in a basic open hearth furnace, consists in melting without lime and with ore addition. The first slag formed carries up to 15% V and is removed. Then the usual slag is formed and heat finished. Total recovery is about 60% V. Many heats of this type were made, all without satisfactory results. 5 experimental heats in acid open hearth furnaces showed reduction to about 0.15% V in the metal and produced slags with about 3% V. Experiments in an acid converter similar to von Seth' (*Metall und Erz,* Vol. 22, 1925, pages 219-222) were not successful. (3b)

Making Black Heart Malleable Iron Using a Cupola. E. A. Kohan & G. N. Troitzki. *Liteinoe Delo,* Vol. 7, No. 6, 1936, pages 26-31. In Russian. Description of an installation of a cupola provided with a separately heated fore-hearth and practice followed for production of malleable castings. (3b)

Recent Developments in Cast Iron. *Foundry Trade Journal,* Vol. 54, Mar. 5, 1936, pages 189, 190. In his remarks before the Staffordshire Iron & Steel Institute, J. G. Pearce discussed the progress made in cast Fe during the last 10 years. Improvements have been made by the free use and alloying of such elements as Ni, Mo, Cr, and Cu with the Fe. A considerable improvement was obtained by introducing into ladle a graphitizer which was termed an inoculant. These inoculants took the form of Ca silicide, or ferro-silicon with Ni, and the strongest irons in England were now made in this way, 30 tons in tensile being obtainable. In 1929 it was discovered in Germany that by superheating cast Fe, the metal was refined and the finest possible type of graphite was produced. The efforts to get this fine graphite were only partially successful. A little Ti was added to the melt and then CO_2 gas was passed through. There was no change when Ti alone was added, but only when the gas was passed through. Pearce believed that the problem which confronted all metallurgists today was the problem of non-metallic inclusions, and this problem would have remarkable similarities for the ferrous and the non-ferrous metals. AIK (3b)

Equilibrium of Fe Oxides in Slags from Refining Furnaces (Sur les Relations d'Équilibre des Oxydes de Fer, dans les Scories des Fours d'Affinage) Tr. Négresco & W. J. Crook. *Comptes Rendus,* Vol. 202, June 29, 1936, pages 2154-2156. Synthetic slags were prepared by melting silica, lime and Fe_2O_3 at 1650° C. From an analysis of these slags equations were set up to show the distribution of total Fe between the Fe_2O_3 and the FeO. A comparison was then made between the synthetic slags and others removed from industrial furnaces. FHC (3b)

Distribution of Sulphur between Metal and Slag. E. Maurer & W. Bischof. *Iron & Coal Trades Review,* Vol. 132, May 22, 1936, pages 950-953; *Blast Furnace & Steel Plant,* Vol. 24, May 1936, pages 410-412. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 442R/9. Ha + MS (3b)

Manufacture of Locomotive Castings. H. Lowe. *Foundry Trade Journal,* Vol. 54, May 21, 1936, pages 397, 398, 410. Paper read before the Edinburgh section of the Institute of British Foundrymen. It refers to the production of locomotive castings at the St. Rollox workshops of the L. M. S. Railway Co. Furnace charges, operations performed by molding machines, gating, core making, etc., are discussed by the author. It is considered that for cast Fe castings of 1" section, pouring temperatures below 1250° C. are to be avoided in the interest of mechanical strength and soundness. For castings of greater section than 1" lower temperatures may be permitted. AIK (3b)

Stream Line Your Steel Castings. Raymond L. Collier. *Iron Age,* Vol. 138, Aug. 6, 1936, pages 38-39, 104. Outlines some practical considerations relating to steel casting design. Gives number of examples. VSP (3b)

Steel Coils are Cast in Iron Pot. *Foundry,* Vol. 64, July 1936, pages 27, 60, 62. Deals with difficulties met with in casting of steel coils and gives detailed solution of the problem. In a number of instances metal should be introduced as rapidly as possible to prevent cold shuts. For that reason metal should be poured from the top rather than from bottom. Problem of enclosing pipe in a casting will not prevent metal from entering coil; an anchorage should be adopted to prevent pipe from wiggling. Considers a typical instance, a cast Fe pot 5 ft. diam., 30" deep, 2¾" side wall thickness and 3½" thick on bottom. VSP (3b)

4. WORKING

4a. Rolling

Electrification of Cold Strip Mill Drives. F. MOHLER. *Iron Age,* Vol. 138, Sept. 17, 1936, pages 40-43. Electric equipment forms an integral part of a mill. Evolution of tempering mill gives a good illustration of part played by electrical equipment. It has developed from a simple pair of rolls, driven at constant speed, to a mill consisting of a pair of working rolls, a tension reel, a set of delivery tension rolls, a set of entry tension rolls, and a feed reel. They are driven by a separate adjustable-speed d.c. motor, except in case of feed reel which requires 2 drag generators. Tempering or skin-pass mills are usually considered the simplest mills from an electrical standpoint. In cold rolling the physical properties, finish accuracy of gage of cold rolled strip are controllable, at least to a large extent. In order to determine the law of rolling the various contributing factors are measured by electric strain gages, tachometers, electro-limit gages, ammeters, etc. VSP (4a)

Jones & Laughlin Now Operating New Blooming Mill. CHARLES LONGENECKER. *Blast Furnace & Steel Plant,* Vol. 24, July 1936, pages 585-589. Describes new 44" blooming mill at Pittsburgh Works. Heated ingots are deposited on a roller table which conveys them to an electrically operated overhead transfer, by means of which they are carried to a parallel roller table which feeds mill approach table. Mill is a 2-high, reversing mill which can roll blooms 6" x 6" or larger and slabs as wide as 48". Rolls have a body length of 90", diam. outside of the collars of 42", are counterbalanced hydraulically by an accumulator, and have a maximum lift of 46½". Screw-down mechanism consists of 2 150 h.p. motors, which separately drive 12" screws, with 2" pitch, through shafting and bevel gears. Mill drive is of the conventional type, with a 7000 h.p. motor. Manipulator is of all-welded construction and is operated by a closed hydraulic system connected to a pneumatic accumulator. Blooms and slabs are cut on a 2000-ton hydraulic shear. MS (4a)

Composition Bearings on Mills and Tables. A. G. DELANEY. *Blast Furnace & Steel Plant,* Vol. 24, July 1936, pages 598-599, 602. Gulf States Steel Company has equipped 18 stands of Garrett rod mill, 9" and 12" bar mills, plate-mill tilting-table rollers, and middle roll bearing and thrust rings on 3-high sheet mill, with composition (Bakelite type plastic) bearings. Results obtained have been very satisfactory, and include savings in power, long life, elimination of grease cost, and improvement of mill practice and product. Successful use of these bearings requires proper application of plenty of H_2O at all times. Roll necks must be unusually well finished and this finish must be retained. MS (4a)

The Influence of Temperature Variations on the Life of Chilled Cast Iron Rolls. N. KRUPNIK. *Stal,* Vol. 6, Jan. 1936, pages 36-39. In Russian. The temperature at various parts of the rolls was measured during operation and shut down periods. Author recommends that internal electric heating elements be installed to reduce breakage. HWR (4a)

Some Considerations Influencing Plant Facilities for Strip-sheet Production under British Conditions. GEO. A. V. RUSSELL. *Engineering,* Vol. 141, May 15, 1936, pages 539-540; *Engineer,* Vol. 161, May 15, 1936, pages 527-528. From a paper read before the Iron & Steel Institute. See *Metals & Alloys,* Vol. 7, Aug. 1936, page MA 401L/3. VSP (4a)

Electrification of Hot Strip Mill Drives. L. A. UMANSKY. *Iron Age,* Vol. 138, Sept. 17, 1936, pages 37-41. Rolling processes and mill machinery are undergoing swift and comprehensive changes. Continuous or semi-continuous hot-strip mills are displacing sheet-bar mills and sheet mills. Some plants favor a reversing universal stand with d.c. driving motor, a separate motor-generator set and reversing control. This arrangement is highly flexible. In many cases several roughing stands arranged in tandem are used. They may be set close together, each stand driven by an adjustable-speed d.c. motor. Rating of electrical machinery for finishing stands may aggregate 75,000 h.p. Commercial success of this rolling method would not be feasible if electrical machinery and control were not available. Hot strip mills may have reached their ultimate development, but it is more probable that progress in this field will continue unabated as has been the case in most other industries. VSP (4a)

Energy Consumption and Specific Power Factors in Rolling Alloy Steels. M. V. VRATSKI & I. M. RUDYKH. *Kachestvennaia Stal,* Vol. 4, No. 7, 1936, pages 21-30. In Russian. Steels containing 0.37% C, 0.35 Si, 0.50 Mn, 3.20 Ni, 1.50 Cr; 1.04 C, 1.56 Cr; 0.66 C, 4.43 Cr, 18.50 W, 0.75 V; 0.35 C, 2.56 Si, 8.90 Cr; 0.20 C, 9.7 Ni, 17.0 Cr were investigated. A three high mill was used and 11 passes were used. Results obtained were treated mathematically and are given in great detail. (4a)

4b. Forging & Extruding

A. W. DEMMLER, SECTION EDITOR

Forging in Hammers, Upsetters and Presses. *Metal Progress,* Vol. 30, October 1936, pages 97-103, 106. Discussion of forging equipment, materials of which hammers are made, forgings made with various equipment and their properties. 8 references. WLC (4b)

New Type of Hydraulic Metal-extrusion Presses. P. WIEGHARDT. *Engineering Progress,* Vol. 12, Feb. 1936, pages 30-31. A small press for the exertion of 2840 lbs./in.^{2} is described. Ha (4b)

Aluminum Pressings—A New Type of Fabricated Shapes. H. L. SMITH, JR. & S. G. MALBY. *Product Engineering,* Vol. 7, Oct. 1936, pages 384-386. Pressed parts are made of specially shaped slugs of any Al alloys which are capable of being forged or extruded. Only one stroke of the press is required to finish a piece. The possible mechanical strength of the pressing is 36,000 to 65,000 lbs./in.^{2} while in not heat treatable Al alloys it is only 16,000 to 29,000 lbs./in.^{2} Wall thicknesses range at present from 1/32" to 2". The process is described in full. Ha (4b)

Study of the Forgeability of Various Light and Ultra-Light Alloys. ALBERT PORTEVIN & PAUL G. BASTIEN. *Journal Institute of Metals,* Vol. 59, Aug. 1936, pages 401-425 (Advance Copy No. 745). Forgeability was estimated from the results of laboratory tests. These tests consisted in compression, bending, Mesnager impact, and tensile impact tests at elevated temperatures. Tests were made on Al, on Al alloys with 6 and 12% Cu, on Al alloys with 5, 10, and 15% Mg. Tests were also made on Mg and on Mg alloys containing 5, 10, and 15% Cu and 3, 6, and 9% Al. The tests indicated that Mg alloys with up to 15% Cu and 9% Al can be extruded, and that those with up to 15% Cu and 7-8% Al can be forged with care. Al alloys containing up to 12% Cu may be extruded and forged with care, while for those containing Mg the limit of forgeability lies between 5 and 10% Mg for metals of the purity employed. 25 references. JLG (4b)

Developments in Modern Drop Forging. R. E. W. HARRISON. *Heat Treating & Forging,* Vol. 22, Jan. 1936, pages 31-34; Feb. 1936, pages 74-78; Mar. 1936, pages 119-122. From a paper read before the American Society of Mechanical Engineers, Dec. 1935. The improvements made in the evolution of drop forging processes are reviewed; the principal reasons for using this method in preference to others are that it gives equal or greater strength at lower unit weight and bulk and greater consistency of performance is obtained than is possible with castings; besides a wider range of heat treatment is available and better machining possibilities. In order to utilize the advantages of the process fully the shop should be laid out with particular attention to the details of handling the material. Schedules and layouts, and several modern forging presses, are described. Ha (4b)

Making Large Forgings in General and Crank Shafts in Particular (Contribution à l'étude de la fabrication des grosses pièces des forge en général et des essieux coudés en particulier) GEORGES DELBART. *Revue de Métallurgie,* Vol. 33, Sept. 1936, pages 543-552. Quality of ingots and blooms used for forging greatly affects the properties of forgings, particularly crystalline features and segregation. Different treatments for making crank shafts of steel containing 0.3% C, 2.5% Ni and 0.5% Cr are critically examined and illustrated with photomicrographs and physical properties. JDG (4b)

Modern Extrusion for Tube Manufacture. GILBERT EVANS. *Metallurgia,* Vol. 14, Sept. 1936, pages 142-144. Discusses adaption of hydraulics to piercing and extrusion of non-ferrous metals that are to be drawn into tubes. Vertical and horizontal presses are compared and a description of a modern horizontal press is given. JLG (4b)

4c. Cold Working — Shearing, Punching, Drawing & Stamping

Rotary Swaging. W. L. BOWER, JR. *American Machinist,* Vol. 80, Sept. 23, 1936, pages 794-795. The production of round sections on shaped bars by a process of multi-blow reduction is described. Ha (4c)

Tip-formation in Deep-drawing of Commercial Silver Sheets (Die Zipfelbildung beim Tiefziehen technischer Silberbleche) E. RAUB. *Mitteilungen des Forschungsinstituts und Probieramts für Edelmetalle,* Vol. 10, Aug.-Sept. 1936, pages 53-68. When cold rolling Ag alloys an orientation of the Ag and Cu crystallites takes place, the rolling texture is formed. The strength of the sheet depends largely on this texture; a pronounced maximum of tensile strength occurs perpendicular to the direction of rolling. In order to avoid formation of tips or points, particularly in deep-drawing, the formation of a pronounced rolling texture should be suppressed; this can be obtained by (1) avoiding too high reductions in rolling, (2) reduction of annealing temperature to about 700° C., (3) change in the direction of rolling. Some influence was also found in the number of annealings applied in the working process. Full data for the behavior of various technically used Ag alloys are given in tables. Ha (4c)

4d. Machining

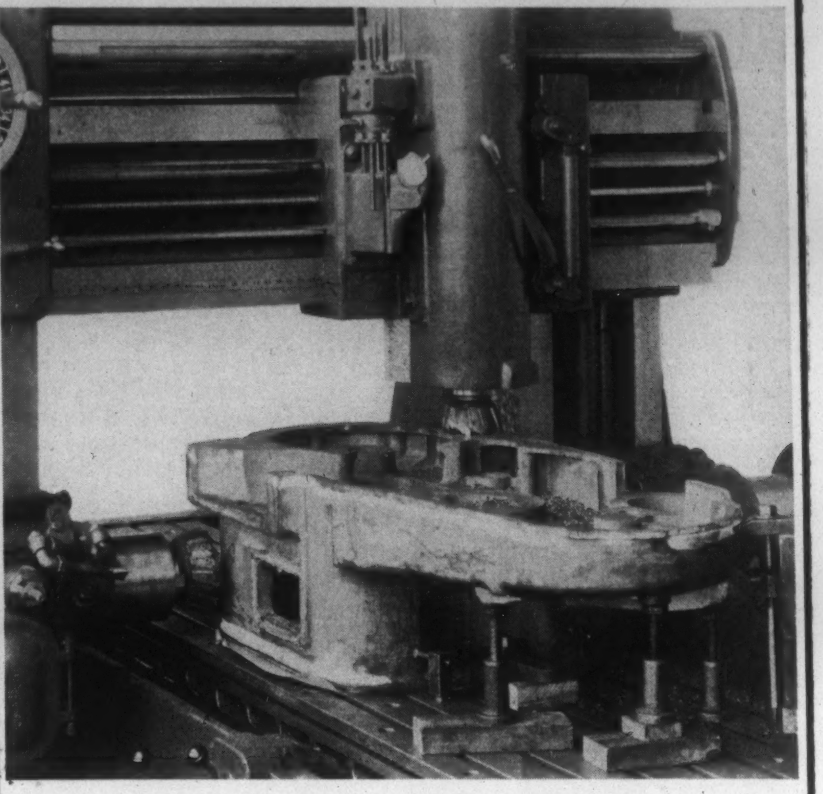
H. W. GRAHAM, SECTION EDITOR

Precision Metal Cutting with Narrow Band Saws. L. A. WILKIE. *Steel,* Vol. 98, June 22, 1936, pages 38-40, 42. Discusses precision cutting of internal and external contours with a sawing-machine using band-saws $\frac{1}{16}$"-$\frac{3}{8}$" wide. Contour hole in a 3" block of steel can be cut at a rate of ½"/min. Blades can cut through steel up to 8" in thickness. For internal sawing, one end of blade is passed through a starting hole in work and the 2 ends are rejoined with Ag solder in an electrical brazing unit provided as part of sawing-machine. Saw is reopened by melting solder in brazing fixture. Blades have back edge of band annealed. Hardness extends only to base of teeth which can not be reset or resharpened. Tempers are soft, medium, and hard. Tooth construction is of the raker type used exclusively for cutting Fe and steel except sheets and tubing; wave type for sawing sheets and tubing and straight type for cutting brass, Cu, and non-metallic materials. Most essential factor for successful narrow blade sawing is use of correct operating speed for each job. Speed is tabulated for various materials and varies from 75 ft./min. for high-Cr, high-C steel to 450 ft./min. for Al. MS (4d)

Super-High Speed Cutting Tools for Non-Ferrous Metals. W. B. FRANCIS. *Metal Industry,* New York, Vol. 33, Sept. 1935, pages 314-315. Advent of new alloys requires new cutting materials. Use of cemented W carbide tools is discussed. Brasses, bronzes, Al, Zn, Cu, Mg, babbitt, solders, spelters, bakelite, rubber and its compounds, porcelain, glass, paper, fiber, linoleum, marble, slate, etc., are machined with these tools. Cemented carbide is also excellent for drawing dies and nozzles. CBJ (4d)

The Machining of Stainless Steels. WILLIAM BUCHANAN. *Metal Treatment,* Vol. 2, Summer 1936, pages 67-71. Stainless steels, particularly those austenitic in character, tend to drag in machining and make it necessary to use a sharper cutting edge, with greater top rake on the tool, than is usual for 3% Ni or Ni-Cr steels of similar tensile properties. Recommended cutting angles, cutting speeds and feeds, and depths of cut are tabulated for rough and finish turning, screw cutting, drilling, and tapping various typical stainless steels. JCC (4d)

Filing of Aluminum and Its Alloys (Travail à la lime sur l'aluminium et ses alliages) *Revue de l'aluminium et ses applications,* Vol. 13, May-June 1936, pages 228-231. After a short survey of the difficulties encountered with files of normal design a new shape of cut files with 9-15 teeth/25 mm. is discussed and illustrated. Description of rotating files, lubricants and cleaning. Rotating files of C steel are used from 4000-6000 r.p.m., those of alloyed steel from 7000-22000 r.p.m. HR (4d)



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5. HEAT TREATMENT

O. E. HARDER, SECTION EDITOR

Close Regulation of Heat-Treating Operations. J. B. NEALEY. *Iron Age,* Vol. 138, Aug. 27, 1936, pages 30-33. Describes some of the steps in close control of heat treating temperatures. Basic principle of most controls is the thermocouple and potentiometer. From this developed the low setting control, and finally the modulating control. Gives details of modulating controls used by a concern making heavy mining machinery and locomotives. Gas is used as fuel in about 20 furnaces of various types to meet all heat treating requirements.. Modulating controls here hold temperature fluctuating to within 2°. Quenching is done in 2 steel tanks: an oil tank of 2500 gal. capacity and a H_2O tank of 2000 gal. capacity. Gears of S.A.E. 2350 steel, drop forged, are heated in car bottom furnace at 1600° F. followed by air quench. Bevel gears are drop forged from S.A.E. 1045 steel. VSP (5)

For Satisfactory Heat Testing Observe These Admonitions. A. S. EVES. *Iron Age,* Vol. 138, Aug. 1936, pages 31, 94. Gives some suggestions to customers as to proper method of specifying what is wanted, such as grade of steel to be used, what the material is to be used for, depth of case hardening, etc. Better work will be accomplished if specifications are in detail. VSP (5)

Practical Methods for Isothermal Treatment of Steel. I. P. LIPILIN. *Kachestvennaia Stal,* Vol. 4, No. 3, 1936, pages 21-29. In Russian. Outlines methods for isothermic treatment of ingots if such were possible. (5)

The Heat Treatment of Nickel and Nickel-Chromium Steels. H. J. FRENCH. *Industry & Welding,* Vol. 8, Apr. 1936, pages 56-60, 63. Physical properties obtained by a number of heat treatments, quench and temper are given in tables for a great many SAE steels, including plain C, Ni, Ni-Cr and Ni-Mo steels. WB (5)

Transmissions to the World. JOSEPH GESCHELIN. *Automotive Industries,* Vol. 25, Aug. 1, 1936, pages 141-155. A well illustrated description is given of the plant, machining equipment and operations of the Warner Gear factory. A special medium carbon Ni-Mo steel (SAE 4640) is used in making transmissions since it gives high fatigue resistance and develops high tensile strength by heat treatment without a heavy loss in ductility. Small volume change and resistance to distortion during heat treatment adapt this alloy to quiet gear operation. Gear blanks are received as drop forgings. They are annealed and passed through a Wheelabrator or subjected to a revolving blast of abrasive shot to secure a tumbled finish, preparatory to metal cutting. Some parts are pack hardened but preferred method is hardening in continuous cyanide baths. Gas atmosphere draw furnaces with automatic conveyors are also used. By fitting the ring bore of a gear with a special Cr-Ni alloy plug before it passes through the heat treating and annealing operations the rate of cooling is retarded in order to produce a softer core. The hardness of the tooth surface may be Rockwell C 50 but the bore only C 30. BWG (5)

Heat Treatment of Light Metal Castings in Electric Furnaces (Die Wärmbehandlung von Leichtmetallguss in Elektroöfen) L. MOENNICH. *Elektrowärme,* Vol. 6, Sept. 1936, pages 265-267. The electric furnace is claimed to be more advantageous and economical than other furnaces for this purpose because of closer temperature regulation, low treating temperatures, pure atmosphere, low heat losses and wide range of temperature adaptability. Examples are described. 6 references. Ha (5)

New Technical Means for Tool Heat Treating Shop. S. L. RUSTEM. *Kachestvennaia Stal,* Vol. 4, No. 2, 1936, pages 43-47. In Russian. Description of the advances in heat treating practice taken from published data. (5)

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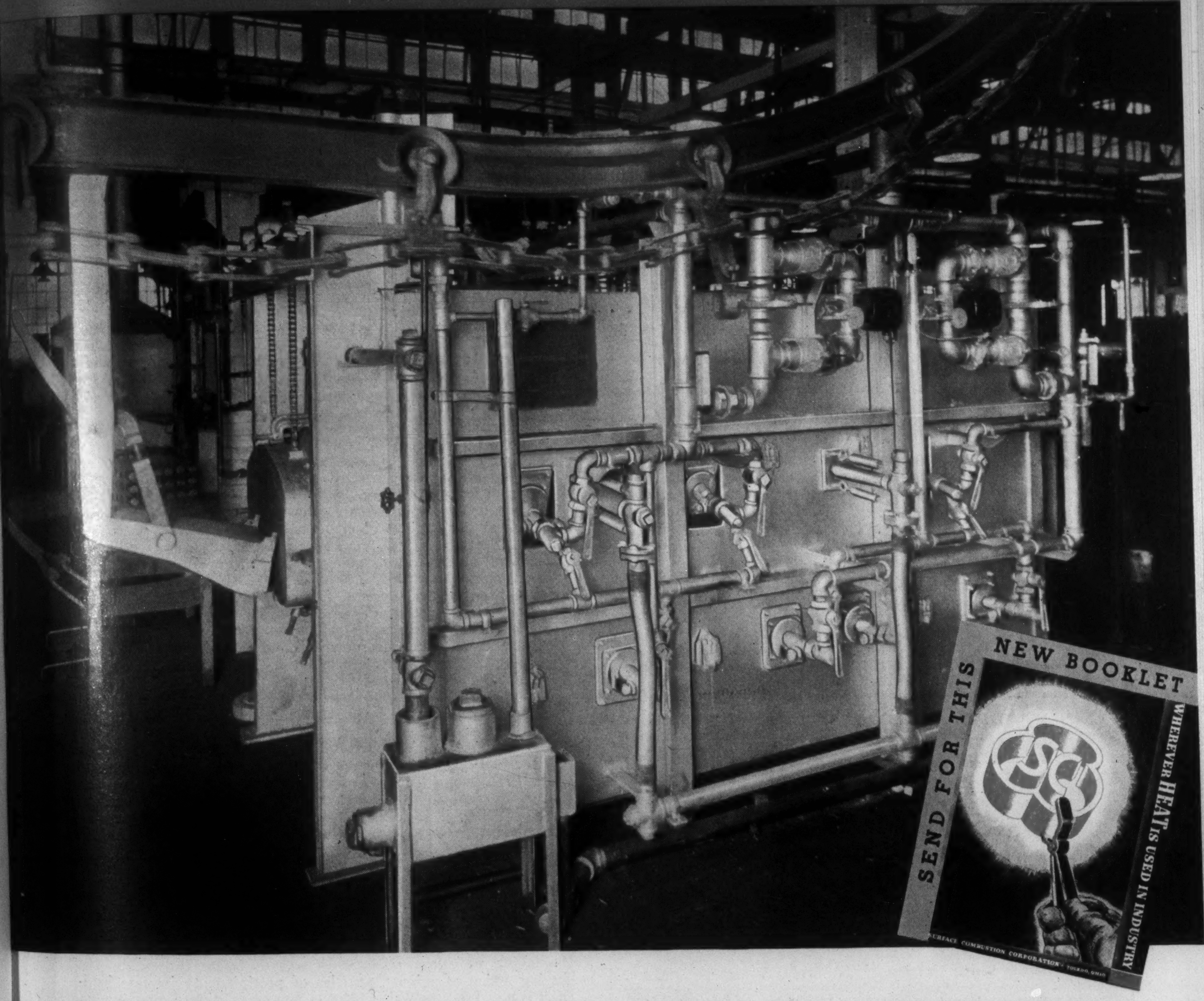
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5a. Annealing

Bright-Annealing Copper. E. K. HANSON. *Electric Journal,* Vol. 33, Sept. 1936, pages 395-398. Requirements for obtaining brightly annealed Cu: (1) The atmosphere must be free from O_2, volatile sulphides such as H_2S, or undue amounts of H, CO, and other reducing gases. Water vapor should be kept low to prevent condensation on the Cu as it is being cooled. (2) Material being annealed must be clean and free from air before it enters the heating chamber. (3) Charge must be cooled below an oxidizing temperature usually around 150° F., before being taken from the furnace. Equipment used is described. CBJ (5a)

Electric Annealing of Brass and Copper. T. B. BECHTEL. *Metal Industry,* New York, Vol. 34, Jan. 1936, pages 12-14. Methods of bright annealing spooled Cu wire in continuous electric furnaces are described. CBJ (5a)

Mechanical Black Plate Separation Reduces Opening Costs One-Third. *Steel,* Vol. 98, June 29, 1936, page 54. Describes an electromagnetic separator for annealed black plate which comprises a curved face magnet and an a.c. hammer which produce a sledging action. MS (5a)

5b. Hardening, Quenching & Drawing

Formation of Soft Spots on Quenching Gages Made of Carbon Tool Steel. G. A. ODING & G. P. IL'ENKO. *Metallurg,* Vol. 11, Aug. 1936, pages 63-72. In Russian. A normal and an abnormal C tool steel were investigated. The presence of gases in quenching liquids leads to formation of soft spots. (5b)

Interrupted Quenching of Die Steel. N. T. GUDSTOV & I. A. SUMIN. *Metallurg,* Vol. 11, Aug. 1936, pages 40-52. In Russian. Steel with 0.54 C, 0.20 Si, 0.51 Mn, 0.65 Cr, 1.92 Ni, 0.62 Mo was studied magnetometrically. Specimens were heated to 900° C. and cooled at constant temperatures in Pb or oil baths. Curves of austenite decomposition are given for temperatures 150°-700° C. Maximum stability was observed at 550° C. Stability of austenite increases with increasing temperature of heating before isothermal treatment, being largely connected with lengthening inertia period. Increasing cooling speed from 900° to 500° C. lengthens inertia period, decreasing shortens it and introduces structural non-uniformity. Transferring specimens from the pre-cooling bath to magnetometer heated to different temperatures indicated a definite increase in austenite transformation rate and its completeness with lowering of temperature. Mechanical properties of steel obtained with interrupted and usual quenching differ but little, but quenching to 300°-200° C. followed by drawing at 525° C. produces a greater toughness. Specimens 20 mm. in diameter and 110 mm. long were used. (5b)

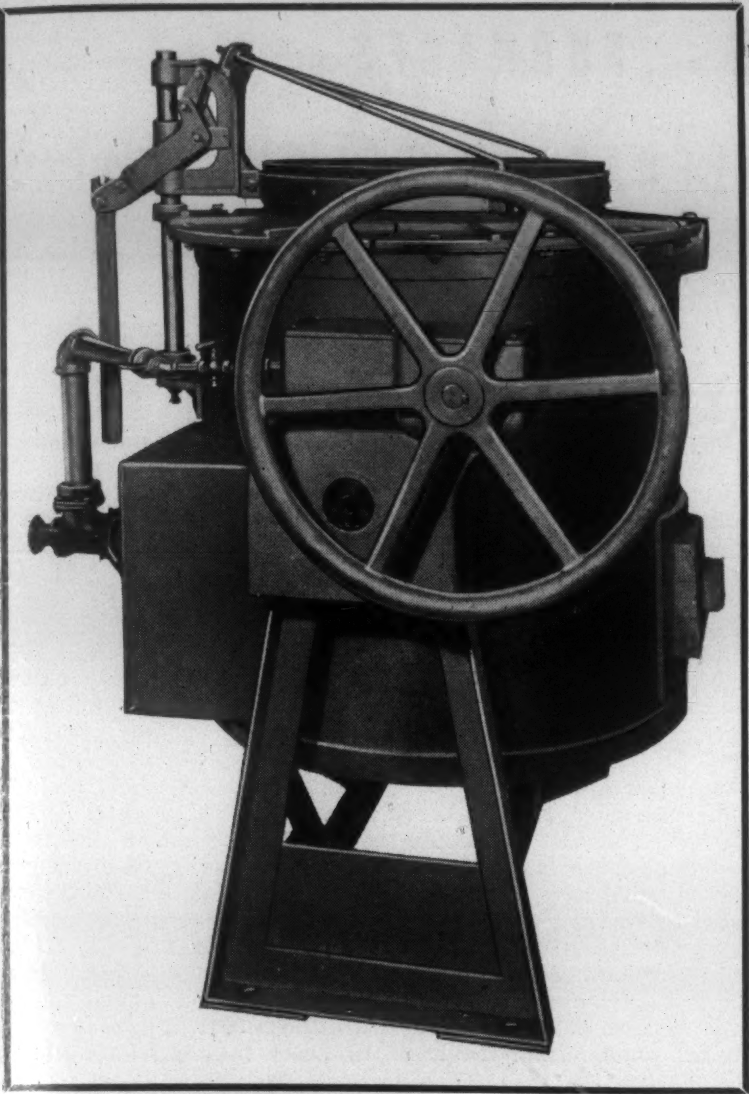
Recent Progress in Hard-facing. *Oxy-Acetylene Tips,* Vol. 15, Jan. 1936, pages 9-11. The use of hard-facing processes in the quantity production of new equipment, as for valve surfaces, caisson sinking, etc., is reviewed and modern examples are described. Ha (5b)

5c. Aging

Structural Hardening and Season Cracking of Solid Solutions. ALBERT PORTEVIN. *Metal Progress,* Vol. 30, Sept. 1936, pages 70-72. Discussion of "age," "precipitation" or "structural" hardening of alloys allowing a solid solution treatment. The keying action of minute particles of precipitate to increase hardness is noted but the writer believes non-uniformity of concentration essential before precipitation can take place. Such non-uniformity of concentration will cause hardening by slip interference by distortion of the lattice. Magnetic and X-ray data indicate that such non-uniformity of concentration occurs in hardened material when precipitation is not detectable. Material of uniform distribution of solute would yield where the distortion due to non-uniform concentration will resist slip. WLC (5c)

5d. Malleableizing

Malleable Iron, Its Heat Treatment in the Electric Furnace (Temperguss, seine Wärmebehandlung im elektrischen Ofen) S. HERBST. *Elektrowärme,* Vol. 6, Sept. 1936, pages 259-264. Purpose of malleableizing, the decarbonization of cast Fe to about 1.2%, is discussed. Batch and continuous electric furnaces for annealing are described. A calculation is made to show their economy. Ha (5d)



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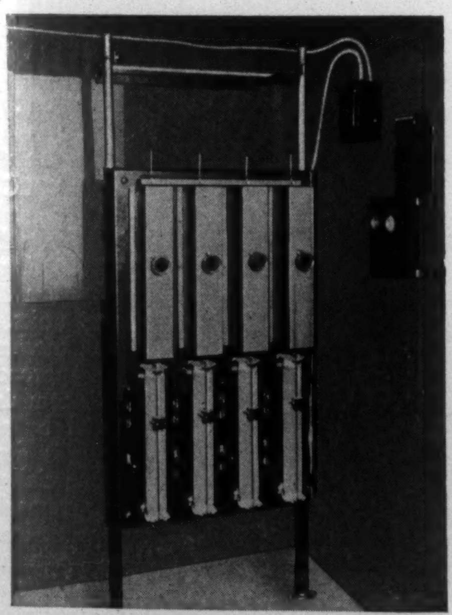

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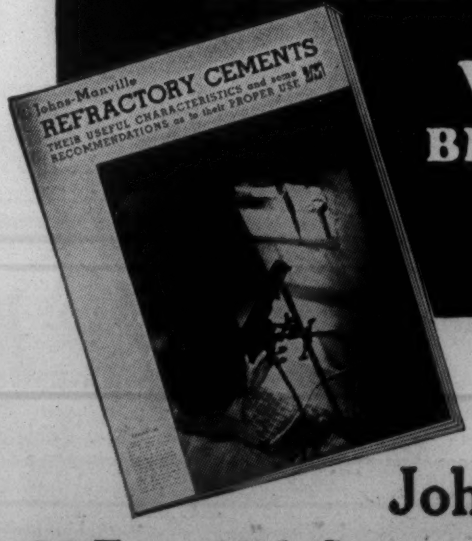
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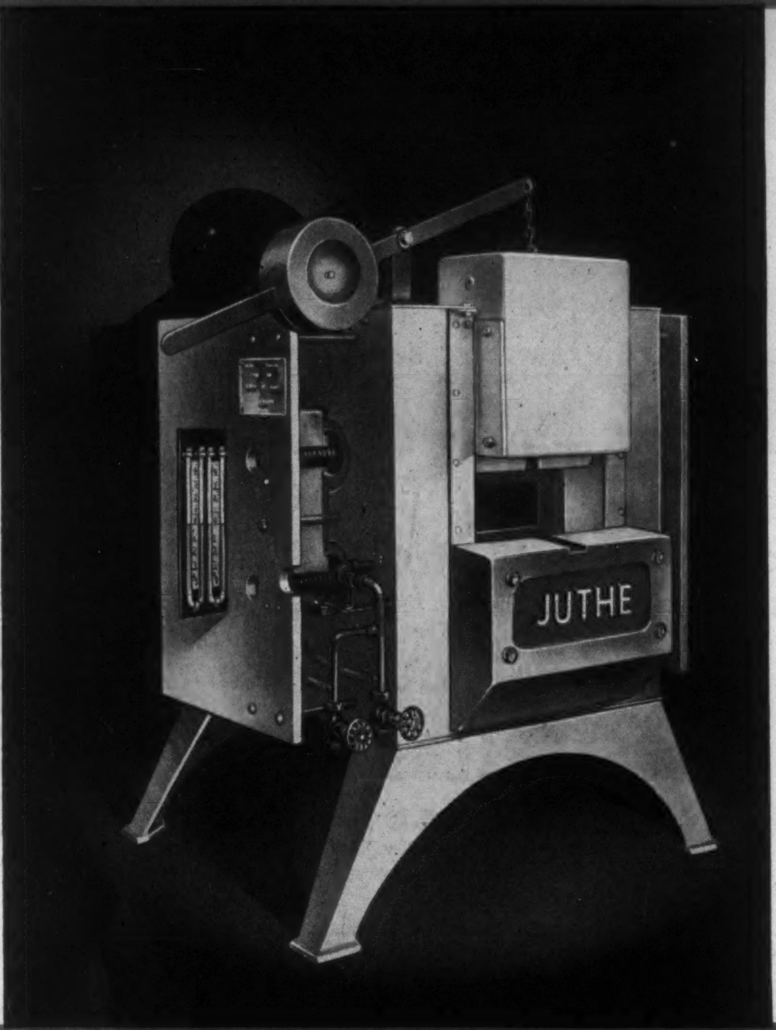

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6. FURNACES, REFRACTORIES AND FUELS

M. H. MAWHINNEY, SECTION EDITOR

Electric Heat in the Foundry (Elektrowärme in der Giesserei) K. Mertens. *Elektrowärme,* Vol. 6, Sept. 1936, pages 254-257. Discusses the advantages of using heat produced without combustion products in many industrial processes and describes a few types of modern electric furnaces for the metallurgical industry, especially for foundry and annealing purposes. Ha (6)

Refractory Materials. I. H. Partridge. *Journal & Record of Transactions Junior Institution of Engineers,* Vol. 46, Apr. 1936, pages 307-326. Paper read in London, Jan. 1936, discusses structure and testing of refractories stressing recent progress in the development of high duty refractory materials. WH (6)

Heat Transfer. Curtis C. Snyder. *Metal Progress,* Vol. 30, Aug. 1936, page 41. Condensed from *Western Canners & Packers.* Stainless steel does not reduce the overall heat transfer in heating installations such as condenser tubing, heating coils and exchangers. This is attributed to: (1) Velocity of heating or cooling and heated or cooled fluid, (2) Nature of material to be heated, (3) Relative temperatures of heating and cooling fluids, (4) Thickness of separating wall, and (5) Character of its surface. Fluid film resistance offsets the use of metals of high thermal conductivity. Oxide films also raise thermal resistance. The following data are quoted from the Dept. of Dairy Industry, University of Wisconsin:

Material	Thermal Conductivity	Overall Coefficient of Heat Transfer
Al	1450	no value
Al alloy	no value	98
Cu	2700	95
Tinned Cu	no value	114
Iron	300	no value
Tinned Iron	no value	123
Inconel	102	92
Nickel	406	98
18-8 Unpolished	102	100
18-8 Polished	no value	98

WLC (6)

Power Generation in the Iron and Steel Industry. A. F. Webber. *Power & Works Engineer,* Vol. 31, July 1936, pages 253-257. Power consuming units in the steel industry are classified as: blast furnace blowers, rolling-mill driving units, and auxiliary machinery including exhausters, pumps, fans, mechanical chargers, conveyors, etc. Modern developments are approaching electrification of rolling-mill drives as contrasted with steam driven machines. Blast furnace blowers are largely supplied by steam turbo-blowers or gas engines. General power supply is derived from surplus blast-furnace gas and from ordinary commercially distributed electricity. Figures are given to show the remarkable high efficiency that can be maintained over a fair range of load by a modern gas-engine generator, as compared with a steam turbo-alternator. Further data indicate the operating efficiency of a modern steam power plant using blast-furnace gas to be only slightly inferior to that of a commercial gas-engine station. FPP (6)

Properties of Insulating Refractories. Part I—The Behavior Under Load at High Temperatures. S. M. Phelps. *Refractories Journal,* Vol. 12, Aug. 1936, pages 415-417. Bulletin copyrighted by American Refractories Institute, Pittsburgh, Pa. Four types of load tests were made on 5 brands of insulating refractories. When tested under a soaking heat at a temperature of 2462° F. using a load proportionate to the weight of the brick and ranging from 6.3-13 lbs./in.^{2}, the subsidence values showed the bricks to be unsatisfactory. A similar test at 1830° F. and 75 lbs./in.^{2} gave satisfactory results. Bricks performed satisfactorily when tested at 2500° F. but heated on one face only, indicating that the mistake of using a load test in which the bricks are under a soaking heat should not be carried over from the clay refractories to the insulating field. The latter tests showed the better grades of insulating refractories possess satisfactory mechanical strength at the maximum temperature which they are intended to stand in service. PCR (6)

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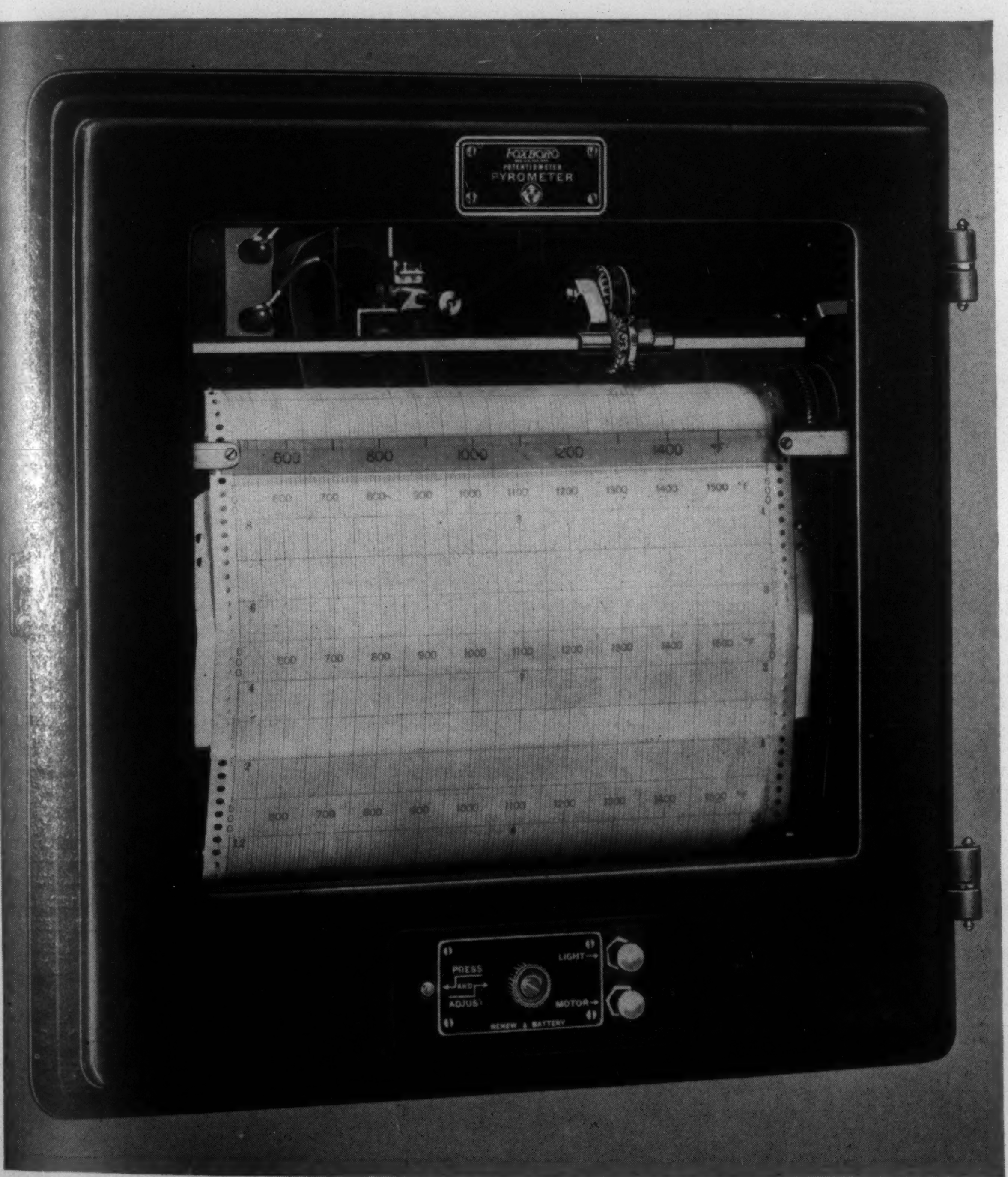

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Its chemical and physical properties qualify it for a variety of uses in industrial furnaces. Under intense heat, shrinkage is kept at a minimum.

P. B. Sillimanite Hydroset, with its simplicity of installation, monolithic construction, high refractoriness, freedom from spalling, high insulating value and reduced heating up and cooling time, is well worth your consideration, no matter how difficult the test you expect to give it. Write our Engineering Department for interesting details.

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Evolution in the Realm of Open-Hearth and Basic Electric Furnaces Linings. Magnesia-Chrome Bricks (Une évolution dans le domaine des revêtements de four Martin et de fours électriques basiques. La brique magnésie-chrome) D. CARABIN. *Journal du Four Electrique,* Vol. 45, Aug. 1936, pages 281-282. Bricks made of a mixture of MgO and Cr_2O_3 have a high fusion point and a remarkable resistance to thermal shock. JDG (6)

Heating of Castings for Hot-working (Das Anwärmen von Gussblöcken für die Warmverformung) A. DOHNS. *Elektrowärme,* Vol. 6, Sept. 1936, pages 269-274. Batch- and continuous furnace types for reheating, normalizing and annealing are described for ferrous and non-ferrous metals. Ha (6)

Thermal Expansion Measurements at Temperatures up to 2000° C. (Ausdehnungsmessungen bei Temperaturen bis 2000° C.) H. EBERT & C. TINGWALDT. *Physikalische Zeitschrift,* Vol. 37, July 1, 1936, pages 471-475. Equipment is described. Experimental results on Al_2O_3, MgO and ZrO are graphically presented. WH (6)

Some Observations Regarding Refractories for Iron Blast Furnaces. ROY A. LINDGREN. *Metals Technology,* Sept. 1936, *American Institute Mining & Metallurgical Engineers Technical Publication* No. 752, 16 pages. Describes functions of blast-furnace brick and gives results of tests on some commercially produced brick. Observations on some stacks are also given. Bricks must be accurate to size and shape; some are ground to exact size. Tests consisting of cyclic heating in a reducing atmosphere proved that Fe content is not a measure of tendency to disintegrate. Brick in a stack may disintegrate and then glaze to give a satisfactory life. JLG (6)

New Method for Making Oxygen and Oxygenated Air (Nouveau procédé de fabrication d'oxygène et d'air suroxygéné) GOMONET. *Revue de Métallurgie,* Vol. 33, Sept. 1936, pages 560-565. Description of a method proposed by Mathias Frankl for oxygen liquification in which the usual tubular heat exchangers are replaced with heat regenerators. The method permits operation at low pressures, 4.5 atmospheres being sufficient, which reduces its costs. Oxygen 97% pure can be obtained by the use of 0.55 h.p./m.^{3} and air containing 45% oxygen at the expenditure of less than 0.12 h.p. Besides enriching blast for furnaces the method offers many industrial applications. JDG (6)

Experiments in the Heating of Large Ingots. W. B. BAXTER. *Proceedings Cleveland Institution of Engineers,* Session. 1935-36, No. 5, pages 311-341, includes discussion; *Engineer,* Vol. 162, Aug. 7, 1936, page 142. Gives results of experiments on the treatment of ingots in the soaking pit. Tests consisted in determining the rate of heating from outside to inside of ingot as this has an important bearing on rolling properties of steel. Ingots allowed to cool to a low temperature are more prone to defects on reheating than if charged hot into pits after teeming. Therefore, tests were also conducted on ingots under conditions considered normal heating practice as well as cooling from teeming. Results showed: (1) a steel ingot is a very slow absorber of heat, (2) in heating an ingot rapidly it is possible to get a lag of 500°-600° C. between outside and inside of ingot, 22" to 29" thick, this occurring when outside is about 1000° C., (3) it takes about 4 hrs. longer for inside of 7 ton ingot to reach 1200° C. than the time taken by outside, a distance of about 11". Better results are obtained by controlling cooling and soaking than by heating and soaking. VSP (6)

Dryer for Foundries (Trockner für Giessereien) SCHMIDT. *Giesserei,* Vol. 23, July 3, 1936, pages 341-342. Some modern installations for drying of molds and cores are described. Ha (6)

The Possibilities of Gas Fuel in the Non-Ferrous Metal Industries. JOSEPH E. WHITE. *Metal Industry,* London, Vol. 48, Jan. 31, 1936, pages 167-169. A portion of a paper presented before a joint meeting of the Institute of Fuel and the Manchester District Association of Gas Engineers. The author lists the following as factors distinctly favorable to "town gas" as the source of heat for practically all phases of the non-ferrous industry: (1) uniformity of quality, (2) low maintenance costs of furnaces, (3) ease of measurement, which eliminates handling, storage and removal of waste products, (4) low first cost burner equipment, and (5) control of excess air reduced to a minimum. The phases to be considered for any industrial operation are cited as (a) high or low temperature, (b) economical operation, (c) various forms of combustion, and (d) fixed dimensions of furnace or its heating chamber. The author discusses the economy of the use of "town gas" for several non-ferrous processes such as melting, extrusion, annealing sheet and strip, and the annealing of brass after cold working. HBG (6)

7. JOINING

7a. Soldering & Brazing

Automatic Soldering Conveyor. CHAS. W. HARDY. *Metal Industry,* New York, Vol. 34, Aug. 1936, pages 293-294. Use of automatic soldering conveyor installation results in increased production, lower labor and material costs, a more uniform joint, better quality, the elimination of the human element in time and heat control, and less floor space. Operation of such a machine is described. CBJ (7a)

Silver Soldering by Electricity. P. H. RYAN. *Journal American Society for Naval Engineers,* Vol. 48, May 1936, pages 239-240. Review of experimental work in adapting electrical heating methods to Ag soldering of Naval pipe fittings. Induction and indirect resistance heating found unsuccessful and successful application of direct resistance heating is discussed. The latter method gives continuous bond of high strength without excessive grain growth in heated zone and is recommended for "in place" soldering of smaller size tubes on board ship. WB (7a)

Progress in Electric Furnace Brazing. H. M. WEBBER. *Iron Age,* Vol. 138, Aug. 6, 1936, pages 24-27, 50. Describes various uses of electric brazing. Electric brazed products have improved appearance, light weight, great strength and rigidity, and tight joints. Some of the products that are electric brazed are: steel fan wheel assembly, refrigerators, automobiles, cash registers, typewriter parts, etc. VSP (7a)

Overdoing Brazing (Les Excès de la Soudo-Brasure) R. MESLIER. *Revue de la Soudure Autogene,* Vol. 28, May 1936, page 11. Author refutes data given by an article published in *La Technique de la Soudure et du Coupage,* Jan.-Feb. 1936. This article says that brazing gives inconsistent results and has only very limited uses. Meslier proves that on the contrary the process has a very large field of application and gives very good results though it may be overdone. FR (7a)

7b. Welding & Cutting

E. V. DAVID, SECTION EDITOR

The Choice of Materials in Welding Design. IV. A B C of Welding Design. V. Methods of Fabrication. VI, VII. Welding for Continuity. VIII, IX. The Design of a Welded Steel Shear. FRED L. PLUMMER. *Industry & Welding,* Vol. 8, May 1936, pages 32-38; June 1936, pages 30, 36; July 1936, pages 34-36; Aug. 1936, pages 43-45; Sept. 1936, pages 30-35. Clear discussion of modulus of elasticity, moment of inertia, tensile strength, etc. of steels, cast Fe and non-ferrous metals. Details advantages of material distribution in shape of cross section to reduce weight and increase stiffness; weld design is considered best method of obtaining these advantages. The use of rolled shapes and forming press for shaping plates gives speedier construction at less cost and least welding. Use of flame cutting preparation for welding is shown to have advantages even in complicated shapes. The stiffness obtained in continuous welded structure is discussed and application of principles to weld designed structure is shown to decrease cost of construction. WB (7b)

You Can Turn on the Heat. E. W. FORKER. *Industry & Welding,* Vol. 8, May 1936, pages 43-47, 53. Discussion of progress in welding due to electrode improvement, in coatings for slag and gaseous protection. On the average 1 to 2 years are required to train welders to qualify for Class 1 work and even then constant check is required. The coupons for physicals of Class 1 work are extensions of the main seam of the vessel welded and stress relieved at same time. Discussion of stress relief at 1200° F. for relief of stress by plastic flow in region where proportional limit is zero. Author considers interpretations of X-rays overemphasized and liable to lead to false conclusions, that a weld may show a good X-ray and poor physicals. X-ray is also limited in that it does not show microstructure, or flaws less than 1% of plate thickness. Large flaws, slag, porosity are located by X-ray. The welding of stainless steels, and non-ferrous alloys is discussed. Careful welding of 18-8 with .07 C max. is practically resistant to intergranular corrosion and as corrosion resistant generally as the base metal for service conditions. WB (7b)

Six Miles of Six Feet Steel Pipe. *Commonwealth Engineer,* Vol. 23, Apr. 1, 1936, pages 271-272. A brief illustrated account of the construction and laying of the 72" pipe-line from Pipehead to Potts Hill, Sydney, stressing manufacture by the spiral welded process. WH (7b)

Prosit. J. S. LITTLEFORD, JR. *Industry & Welding,* Vol. 8, May 1936, pages 18-24. Discusses various welded units for brewing beer. WB (7b)

Welding Goes Fishing. W. E. MCCAIN. *Industry & Welding,* Vol. 8, June 1936, pages 20-21. Welded fishing boats made of 3/16" Cu bearing Fe sheet. A 55' boat was within 3/8" of design when completed. WB (7b)

Comparative Investigations of Core and Mantle Electrodes (Vergleichende Untersuchungen an Seelen- und Mantelelektroden) F. LEITNER. *Zeitschrift Verein deutscher Ingenieure,* Vol. 80, July 11, 1936, pages 851-856. The various points which determine the efficiency and economy of a welding process are reviewed and it is investigated whether core or mantle coated electrodes are better. While the O and N of the air are kept away from the weld by the coating of the coated electrode, the same effect is obtained in the core electrode by addition of alloying elements which bind a large part of O and N and transform them into a harmless form. Core electrodes are preferably used with d.c., the electrodes being the negative pole; coated electrodes are more convenient for a.c. as the arc can be conducted more easily but, on the other hand, the danger of slag inclusions is greater The coated electrode gives a smoother appearance than core electrodes, but the latter produce welds practically without risk of cracks and are cheaper than coated electrodes. The melted weight is about 0.7-0.9 kg./kw.hr. for core electrodes and 0.4-0.5 kg./kw.hr. for coated electrodes. A few practical examples of welds with the 2 types are described, and tables of the respective mechanical strengths given. Ha (7b)

Electric Arc Welding and Its Applications XIII. M. MAURICE LEBRUN. *Welding Journal,* London, Vol. 33, June 1936, pages 166-168, 186. Discussion of pipe welding, arc weld repairs of boilers, castings, bridges. Photos are given of repairs on cast Fe cylinders of blast furnace gas engines accomplished by studying. WB (7b)

Welding Bells for Butt Welded Pipes. M. S. KOMAROV. *Metallurg,* Vol. 11, Aug. 1936, pages 111-115. In Russian. A formula giving the shape of welding bells designed to produce best results is given on the basis of theoretical considerations. The use of inserts is recommended because the method simplifies construction, increases life and speeds replacements. (7b)

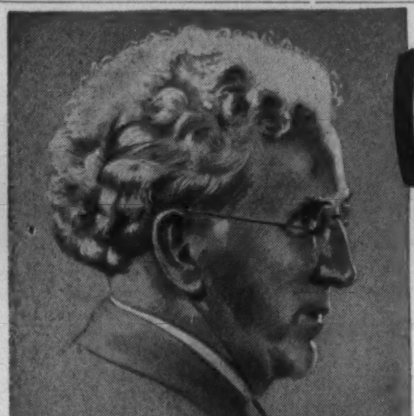
Welded High Pressure Vessels. W. M. KINGHORN. *Journal South African Institute of Engineers,* Vol. 35, Sept. 1936, pages 32-43. A review of latest developments in the manufacture of high-pressure and high temperature vessels. Coated electrodes are required for welding of pressure vessels. The method of obtaining an all-weld metal, the actual depositing of the metal and its relation to the parent metal are discussed. WHB (7b)

Welding Rods in Oxyacetylene Welding (Métaux d'apport pour soudure oxy-acétylénique) M. MERCIER. *Revue de Métallurgie,* Vol. 33, Sept. 1936, pages 553-555. General remarks regarding advantages of using proper welding rods in oxyacetylene welding. JDG (7b)

Ore Bin All-Welded. FRED J. MEEK. *Industry & Welding,* Vol. 8, July 1936, pages 18-19. Discussion and photographs. WB (7b)

Electric Arc Welding in Bridge Construction. L. F. LODER. *Commonwealth Engineer,* Vol. 23, Mar. 2, 1936, pages 255-256. Information taken from the Annual Report of the Victorian Country Roads Board discusses calculation of forces, type of joints, electrode gages, and welding currents, and other practical aspects of welded bridge construction. WH (7b)

Electric Arc Welding and Its Applications. XI. M. MAURICE LEBRUN. *Welding Journal,* London, Vol. 33, Apr. 1936, pages 102-105. Applications are discussed for electric transmission pylons, bridges, hull construction. WB (7b)



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Junk to Profits. S. A. SWANSON. *Industry & Welding,* Vol. 8, Aug. 1936, pages 13-14. Several new pieces of equipment are detailed in text and photos as built up from cast-off cast Fe and steel parts. WB (7b)

Economical and Practical View Points for Assembling and Reconditioning Passenger Cars (Wirtschaftliche und praktische Gesichtspunkte bei der Neufertigung und Instandsetzung von Wagen) C. STIELER. *Organ für die Fortschritte des Eisenbahnwesens,* Vol. 91, *Fachheft "Das Schweissen im Eisenbahnwagenbau,"* June 15, 1936, pages 233-237. The well illustrated paper gives an account of modern welding as practiced in German railway shops with special reference to problems arising from design and assembling of Pullmans. WH (7b)

The Rebuilding of Rotary Drilling Bits. GEORGE F. STALEY. *Industry & Welding,* Vol. 8, Sept. 1936, pages 18-23. The use of B and WC inserts welded to drilling bit by flowing weld rod metal over the inserted hard material is compared with former use of diamond bits set into Cu. Procedure for preparing bit for inserts is detailed and shown in photographs from start to finish. Either of two methods is used, forming a pool of molten metal from welding rod and dropping inserts into the pool. The more recent method is to groove the bit with reamer or gouging torch, lay the inserts into the metal grooves and cover with weld metal. The bit is finished with final overlay of hard facing metal. Inlaying is still another method of rebuilding and consists of grooving the bit and filling the grooves with hard facing metal. One reason for occasional failure of rebuilt bits is that high C rod deposited over inserts or inlays was melted with too hot an arc thus burning the deposited metal and the bit steel. WB (7b)

Hard-facing Methods for Agricultural Implements. GEORGE STALEY. *Industry & Welding,* Vol. 8, May 1936, pages 9-12. Hard-faced implements last longer than new original equipment and do not need resharpening; therefore cost of hard facing should be compared on basis of cost of new equipment rather than cost of resharpening. Where tool is badly worn or steel can be damaged by heat hard-facing is not applied. C steels over .50 C should not be hard faced due to coarse grain and brittleness produced. Self sharpening of tools is discussed and illustrated. Deposit procedure on implements outlined. Max. thickness not to exceed .015″. WB (7b)

Welding Lead Sheets and Pipe. F. E. ROGERS. *Heating, Piping & Air Conditioning,* Vol. 8, Sept. 1936, pages 487-490. Lead burning or the welding of Pb with a gas torch is used in applying linings to acid or other tanks and in joining Pb piping for process services. Practical suggestions are given on the proper technique and manipulation. CBJ (7b)

Welded Structural Designing. H. M. PUDDY. *Welder,* Vol. 8, July 1936, pages 995-996. First of a series of articles on weld design. Discussion of responsibilities of the drafting room. WB (7b)

Repair of Crawler Treads and Grousers. E. R. RANDALL. *Industry & Welding,* Vol. 8, Aug. 1936, page 20. Ni-Mn bars welded on treads. WB (7b)

Experiences on Welded Freight Cars of the Standard Type (Erfahrungen mit geschweissten Güterwagen der Normalbauart) SCHINKE. *Organ für die Fortschritte des Eisenbahnwesens,* Vol. 91, *Fachheft "Das Schweissen im Eisenbahnwagenbau,"* June 15, 1936, pages 248-256. Reports on personal experiences with standard German freight cars as to (1) weight savings by welding, (2) simpler design due to adoption of welding, (3) torsional stiffness (rigidity) of welded freight cars, (4) assembling methods based on welding. WH (7b)

Wire Welding Rod Production. RICHARD SAXTON. *Mechanical World & Engineering Record,* Vol. 100, Aug. 28, 1936, page 197. The treatment of wire in its preparation for welding rods depends to some extent upon the welding process for which it is to be used. For the rest, the wire drawer's art and recent research enable desirable properties to be developed. WH (7b)

The Progress of Electric Welding in Ship Construction. E. F. SPANNER. *Welder,* Vol. 8, July 1936, pages 1016-1018. Discussion of Kjekstads free flow, framing system of welded stiffness for hull construction. Advantages of the system are enumerated. WB (7b)

Effect of Weld Penetration on Stresses in Fillet-Weld Joints. ARSHAG G. SOLAKIAN. *Welding Journal,* N. Y., Vol. 15, Sept. 1936, Supplement, pages 13-16. Photoelastic studies are reported for fillet welds, shear stresses are calculated and shown in graphs, stress concentration factors such as weld penetration discussed and underpenetration shown to be injurious to weld strength. WB (7b)

Alloy Weld Technique. M. C. SMITH. *American Machinist,* Vol. 80, Aug. 26, 1936, pages 722-724. Reactions in and behavior of alloy steels in welding are discussed in general. C steels containing Cr have a tendency toward abnormal grain growth when subjected to heat. Carbides form adjacent to the weld and if these areas are not normalized after welding they are brittle. Addition of Ni makes Cr alloys weldable. Cr-Ni, Cr-V and similar alloys can readily be welded with correct welding rod and welding procedure; in this case the physical properties of both the weld and the parent metal are retained. Illustrations by microphotographs of the structure are given, and properties of welding rods described. Ha (7b)

Special Features of Coal Hydrogenation Plant. II. F. E. SMITH. *Mechanical World & Engineering Record,* Vol. 100, July 10, 1936, pages 29-30. The pressure and temperature conditions of the hydrogenation process require the use of alloy steel which is difficult to weld without disturbing its composition. This difficulty was overcome in the case of the piping by a specially built butt resistance welder, the use of which is described. WH (7b)

Arc Welding Supplants Rivets in Construction of De-airating Heaters. E. W. P. SMITH. *Welding Engineer,* Vol. 21, June 1936, pages 36-37. Review of practice plus photos of finished all welded equipment. WB (7b)

Welding the Modern Boiler. I, II. E. R. FISH. *Industry & Welding,* Vol. 8, Aug. 1936, pages 39-42; Sept. 1936, pages 15-17. Discussion of welder qualification, welding procedure and pressure vessel code requirements. Results of tests on trepanned plugs cut across welds and deep etched are detailed and alternative method of inspection by cutting narrow plot across weld is discussed. Alternative method would require special cutting tools but closure of hole by welding would be less difficult than for trepanned holes. WB (7b)

Application of the Oxy-acetylene Flame for Cutting and Welding (Applications du Chalumeau à l'Oxy-coupage et à la Soudure) W. L. FAIRMAN. *Usine,* Vol. 45, Aug. 6, 1936, pages 25-27; Aug. 20, 1936, pages 25-27. Present practice is briefly discussed giving examples. Ha (7b)

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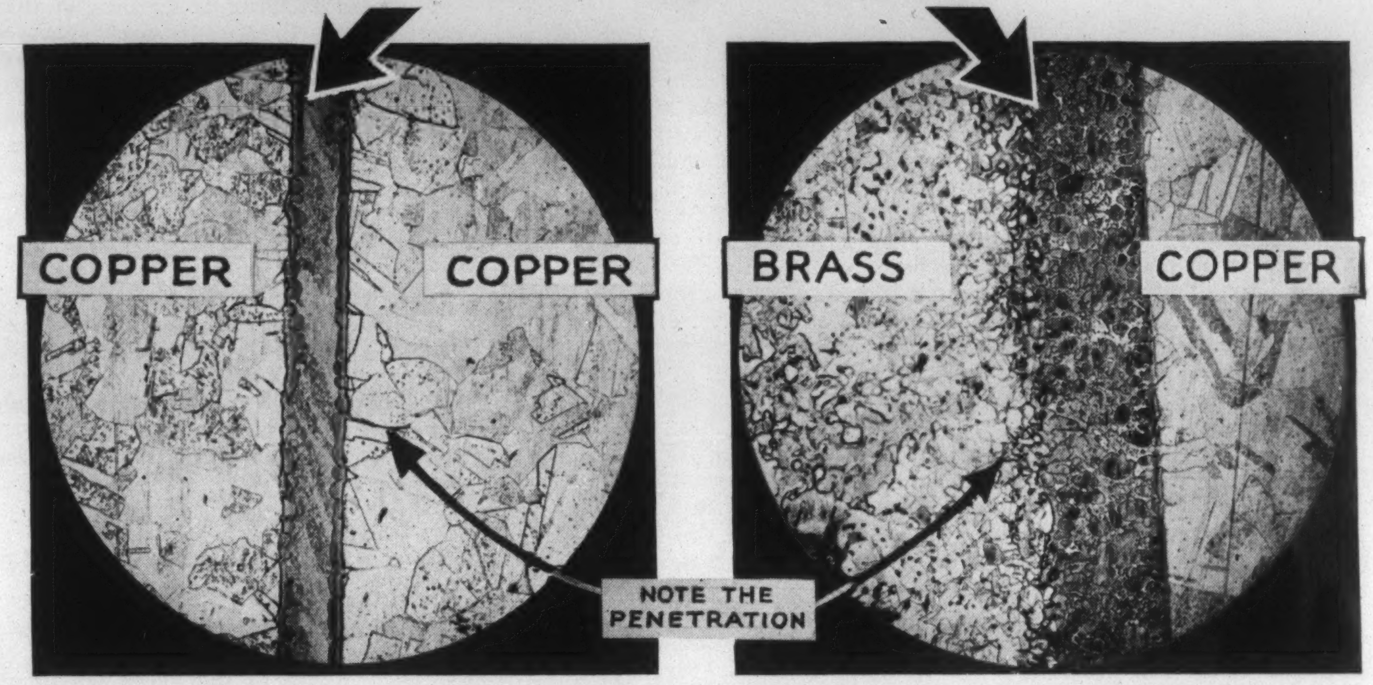

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Vehicle Construction Governed by Welding Methods (Schweissgerechtes Konstruieren im Fahrzeugbau) MAUERER. *Organ für die Fortschritte des Eisenbahnwesens,* Vol. 91, *Fachheft "Das Schweissen im Eisenbahnwagenbau,"* June 15, 1936, pages 237-241. Discusses how modern welding methods affected the design of rolling stock formerly riveted, and illustrates welded joints as well as larger members of vehicles after welding. WH (7b)

Metallurgical Cutting for Fabrication, Repair, or Demolition. H. H. MOSS. *Mining & Metallurgy,* Vol. 17, Aug. 1936, pages 376-379. Marked changes have been made in oxyacetylene cutting with advancement of metallurgical science in production of special alloy steels. Flame cutting of low-C steels brings about changes in physical properties which are in no way detrimental to their serviceability. In alloy, and high C steels, troostite and even martensite may result on cooling after cutting. Special steels should be preheated (below 1100° F.) before being cut. Temperatures as low as 500°-600° F. are beneficial. Selection of proper cutting nozzle is also important. Of primary importance in determining economy and efficiency are drag, speed and O_2 pressure. Discusses the technique developed for cutting the different ferrous metals. VSP (7b)

Arc-Welded Bridges—a Survey. A. R. MOON. *Structural Engineer,* Vol. 14, Aug. 1936, pages 335-350. Paper read before Scottish Branch of the Institution of Structural Engineers at Glasgow, Mar. 1936. The use of arc welding in bridge construction is still young, but certain well defined trends are discernible and the advantages are taking definite shape. The influence of welding on cost varies with the location of the bridge, the facilities available and the skill of personnel. The advantages of welding, as applied e.g. to short span beam bridges, are simplification of details, possibility of fabrication on the site, ease of insuring water tightness, usefulness in combined steel-concrete structures, elimination of protruding rivet heads, and easy strengthening when necessary. 15 detail diagrams and photographs illustrate a variety of applications of welding in bridge construction. FPP (7b)

Effective Track-Welding Demands Careful Planning. *Railway Engineering & Maintenance,* Vol. 32, Aug. 1936, pages 477-479. From a report to the American Railway Engineering Association. The principles and considerations that should underlie the formulation of track-welding programs are outlined and basic track-welding organizations are suggested. FPP (7b)

Electrostatic Charges by Flowing Gases (Elektrostatische Aufladungen durch fliessende Gase) W. RIMARSKI & H. FRIEDRICH. *Autogene Metallbearbeitung,* Vol. 29, Aug. 1, 1936, pages 225-232; Aug. 15, 1936, pages 241-246. The danger of electric charging of pipes by the gases flowing in them, with particular reference to acetylene welding apparatus is pointed out. Effect of shape of nozzles, speed of gases and other factors was investigated; the results are shown in curves. Grounding the apparatus does not fully eliminate the danger but it can be largely reduced by proper shape of the nozzle. Heating of the gas flow locally before the places where charging occurs entirely eliminates charging of gas and gas-developing apparatus. Ha (7b)

Arc Welding Bi-metals. G. M. TICHODEEV. *Kachestvennaia Stal,* Vol. 4, No. 7, 1936. In Russian. The results obtained with arc welding bimetallic sheets using joints prepared in 6 different ways. Best results were produced in welds made by butt welding sheets which were bent flat on soft steel side so that only the stainless coating was actually welded. Stainless electrodes were used. Welds produced were checked for corrosion resisting properties by subjecting them to the action of foods of the canning variety and were found satisfactory. (7b)

Proposed Impact Test Specimen. A. VOGEL. *Welding Journal,* N. Y., Vol. 15, Sept. 1936 Supplement, pages 11-12. A test sample is proposed for determining Charpy impact of fillet weld with which quantitative results in ft.-lbs. would enable determination of weld qualities and procedure required for max. toughness. Method of preparing sample, fixture for holding in Charpy machine and type of break obtained are shown in photos. WB (7b)

The Logs Roll with Welding. HENRY W. YOUNG. *Industry & Welding,* Vol. 8, June 1936, pages 23-29. Logging operations in Pacific Northwest are described as carried out with tractor-cruisers of welded construction. Severe service is encounterd in dragging large logs over rough terrain. Former heavy castings on cruisers were replaced by welded construction to reduce power consumed in return to drag out other logs, strength was increased as shown by lack of failure of welded design. Former castings frequently failed due to severity of service; in new design of high tensile steel plate, strength can be placed where needed. Plate is shaped with cutting torch and all material is used in shop thus eliminating scrap. WB (7b)

8. FINISHING

H. S. RAWDON, SECTION EDITOR

Plating and Polishing Departments Tell an Interesting Story. CARLETON CLEVELAND. *Mill & Factory,* Vol. 19, Sept. 1936, pages 53-55, 158. A general description is given of the layout of Stewart-Warner's plating and polishing department, and of the equipment, power and procedure required to handle the extremely diversified production at this plant. FPP (8)

8a. Pickling

Note on Pickling or Etching Baths for Duralumin. H. SUTTON & T. J. PEAKE. *Journal Institute of Metals,* Vol. 59, May 1936, pages 243-252 (Advance Copy No. 736). Search was made to find a bath that would not require HF. Treatment in a bath containing 1% by weight of NaF to a 10% H_2SO_4 solution followed by dipping in 50% HNO_3 gave satisfactory etching. The Wöhler fatigue limit for 10 million cycles was reduced from 10.85 to 10.1 tons/in.^{2} by pickling in this bath, a reduction of only 6.9%. The bath was considered to be the most satisfactory yet found. JLG (8a)

The Use of a Filter Press in the Pickle Room. D. L. BENSINGER. *Enamelist,* Vol. 13, July 1936, pages 16-17, 47. Use of a filter press in connection with the neutralizer tank in enameling plants decreases the concentration of insoluble salts in the neutralizer solution, and thereby reduces the danger of ground-coat trouble from this source. A typical hook-up is given. PCR (8a)

8b. Cleaning including Sand Blasting

Airless Sand-Blastings. *Foundry Trade Journal,* Vol. 55, July 16, 1936, page 43. The centrifugal type of sand blaster is discussed and photographs of two types are shown. AIK (8b)

Cleaning of Metallic Surfaces by Metallic Grit (Nettoyage des Surfaces Métalliques par Grenaillage) *Usine,* Vol. 45, Aug. 13, 1936, pages 25-27. Methods of cleaning by blasting or impact with granulated metal, mostly steel, grain size required for different pieces to be cleaned, and present-day fields of usefulness are discussed at length. Principal advantage is that the dust accompanying the process is much less dangerous than when sand or siliceous matter is employed. Its operation is simple and overhead costs are reduced. Ha (8b)

Metso 66. *Silicate P's & Q's,* Vol. 16, July 1936, page 2. Metso 66 is a new compounded Na metasilicate for metal cleaning for use in plating or enameling. FBH (8b)

Blast Cleaning. EDWARD VAN DER PYL & HAROLD HOLDEN. *Enamelist,* Vol. 13, Sept. 1936, pages 27-30, 48. A study of nozzles used in air-blast equipment shows boron carbide to be more efficient than hard Fe. PCR (8b)

Chemistry and Mechanics of Metal Cleaning. D. J. BENOLIEL. *Ceramic Industry,* Vol. 27, July 1936, pages 24-26; Aug. 1936, pages 102-107. Presented before the Enamel Division of the 1936 Convention of the American Ceramic Society. Discusses all factors of cleaning for enameling. Since the introduction of emulsifying cleansers, mineral oil competes with soaps and fats as lubricant in the drawing operation. The latter may cause rinsing difficulties through the formation of excess soap. The action of metal cleansers depends upon solution, chemical action, emulsification, mechanical action or various combinations of these. Ordinarily only chemical action leaves a surface chemically clean. Need of high Na_2O content in commercial cleansers is stressed. The surface of the cleaning bath on the working side of the tank is kept free of excess oil and suds by the proper arrangement of heating coils, water inlets and air jets. For greatest efficiency the temperature of cleaner is kept at boiling point. A warm rinse is superior to a cold rinse. A simple physical test to measure the cleaning speed of a solution is given. PCR (8b)

8c. Polishing & Grinding

Rail Grinders—What Progress in their Development?. *Railway Engineering & Maintenance,* Vol. 32, Sept. 1936, pages 539-541. Since the introduction of track grinders, constant redesign and development has been carried out. Track grinders may be classified as (a) rail surface grinders, (b) side flow grinders and (c) cross grinders. Rail surface grinders are further subdivided into those using revolving wheels, and those of the reciprocating type. FPP (8c)

Carbides Ground in Half the Time. N. N. SHEPHERD. *American Machinist,* Vol. 80, July 1, 1936, pages 573-576. Recent developments in grinding technique, grinding wheels and grinding machines are described, and the basic requirements for rapid carbide tool grinding explained by illustrations. Ha (8c)

The Polishing of Metals. E. J. DOBBS. *Metal Industry,* London, Vol. 48, Feb. 21, 1936, pages 234-236, 241. Condensation of a paper presented before a meeting of the Midland Metallurgical Societies at Birmingham. The discussion is included. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 453L/7. HBG (8c)

Polishing Aluminum Castings. F. B. JACOBS. *Metal Cleaning & Finishing,* Vol. 7, Aug. 1935, pages 389-390. Al alloy of 95% Al, 5% Si, is common one for the polisher to handle. Chief polishing difficulty is drag marks. For flat surfaces a leather faced wood wheel is suggested. For contours compressed leather, stitched muslin or canvas, or felt wheels are suitable and can be shaped to fit surface being polished. Five general types of abrasives are available: Turkish emery (several varieties depending on mine) averaging 50-60% alumina, Naxos emery (harder than Turkish), American emery (softer than either of above) containing 50% alumina, Natural Corundum (95% alumina), Manufactured Alumina (pure alumina). Chief impurity in most emery is Fe oxide. Alumina, which is used in large amounts, is fast cutting. Wheel speed should be at least 8000 ft./min. For coloring, lime is used on a muslin buff at 10,000 ft./min. GBH (8c)

8d. Electroplating

Characteristics of Nickel Deposited at High Current Densities. W. BLUM & C. KASPAR. *Metal Cleaning & Finishing,* Vol. 7, Aug. 1935, pages 407-409. See *Metals & Alloys,* Vol. 7, Apr. 1936, page MA 195L/3. GBH (8d)

Tungsten Deposited by Novel Process. *Automotive Industries,* Vol. 75, Sept. 12, 1936, page 353. W may be electrodeposited in conjunction with one or more metals from the same electrolytic bath. Standard Ni plating equipment is adaptable for this simple method. Deposits are dense, adherent and extremely resistant to corrosion, erosion and heat. Steel test plates coated with .0002" of W-Ni with an intermediate coating of .0001" of Ni remained in a salt spray for 172 hours without tarnishing. These coatings may be carburized to give added hardness. CMH (8d)

Electrodeposition of Chromium for Wear Resistance. JOHN KRONSBEIN. *Electrometallurgy,* supplement to *Metal Industry,* London, Vol. 48, Feb. 7, 1936, pages 193,194. Paper read before the Electrodepositors' Technical Society. The term "hard" Cr plate, used to differentiate it from Cr plate solely for decoration is defined as the plate applied to undercoats of Cu, Ni, or both metals. The plating processes discussed refer exclusively to applications to steel. The purpose of a Cr plate on steel is to provide a hard surface to resist abrasive wear. The author states that at least a dozen different types of solutions are known which are suitable for this. Most of them have chromic acid as the basis. One exception however has $K_2Cr_2O_7$ as its chief constituent. Several disadvantages of this type of solution are indicated. The author lists as a formula which will give reasonably good results the following: 250 g. CrO_3, 2.4 g. H_2SO_4, 1 l. H_2O to be used at a temperature of 98° — 105° F. (37° — 41° C.), current densities ranging from 80 to 200 amps./ft.^{2} A Westinghouse plating rectifier is suggested as more satisfactory than a low tension motor-generator set. The relatively low throwing power of Cr solutions is attributed to cathode inefficiency. The necessary addition of anodes, to compensate for the cathode inefficiency, when Cr deposit of .001" or more is required, varies with each job. Good practice, however, is to keep the anode area approx. 2/3 the cathode area. Control of the solution is not difficult but the sulphate ratio should be kept above 60 and preferably just below 100. A number of commercial applications are briefly outlined. HBG (8d)

Deposition on Non-Conducting Surfaces. E. A. OLLARD. *Electrometallurgy,* supplement to *Metal Industry,* London, Vol. 48, Feb. 7, 1936, pages 191-193. In electrodeposition, the metal is deposited on a substance which is a conductor of electricity. In electrotyping and electroforming processes it is frequently necessary to deposit on some non-conducting substance. To do this the surface must be made conducting. The author reviews different processes for doing this and indicates which processes are suitable for different types of work. Processes discussed include those utilizing graphite and bronze powders, and those dependent upon the reduction of Ag and upon a vacuum technique. It is essential in all that a good contact be made for the conducting surface is very thin, fragile, and has a high resistance. A constant-voltage generator for supplying current is recommended, otherwise constant attention will be required to readjust the voltage by a rheostat. HBG (8d)

Elytal Process (Das Elytal-Verfahren) H. GINSBERG. *Aluminium,* Vol. 18, Sept. 1936, pages 441-442. The elytal process permits electroplating Al or Al alloys directly, without any intermediary metallic layer; its principle is to produce a non-metallic intermediary layer instead of removing the oxide films present on the Al surface. Degreased parts which have been freed from their oxide film in a NaOH solution saturated with NaCl are treated in an acid electrolyte with a.c. or d.c. in such manner that the Al surface is covered with an oxide film which, in turn, is removed or loosened in an alkaline solution; this treatment creates a surface on which a firmly adhering metal layer can be deposited electrolytically. The deposits have a very dense texture and can be brightly polished; they are corrosion-resistant, and not attacked in a 10% soda solution. They do not tarnish, and adhere even at 150° C. The process is patented by DRP 546,388. Ha (8d)

Electrogalvanizing Process Produces Ductile, Corrosion Resistant Coatings. U. C. TAINTON. *Steel,* Vol. 98, May 18, 1936, pages 40, 42-43. See "The Basic Theory of the New 'Bethanizing' Process," *Metals & Alloys,* Vol. 7, Oct. 1936, page MA 501L/5. MS (8d)

Plating by the Ampere-hour Meter Method. ROBERT W. WILSON. *Metal Industry,* New York, Vol. 34, Oct. 1936, pages 387-388. Accurate knowledge of thickness is secured which results in economy by avoiding overplating. CBJ (8d)

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8e. Metallic Coatings other than Electroplating

Selecting the Hard-Facing Alloy. *Oxy-Acetylene Tips,* Vol. 15, Oct. 1936, pages 226-227. Hard facing materials are classified according to composition. Typical applications and characteristics of deposits are given. Factors influencing the life of a hard-faced part are: sliding or rolling friction, shock or impact, heat, and corrosion. CBJ (8e)

Metallizing. E. L. MATHY. *Industry & Welding,* Vol. 8, June 1936, pages 45-47. Careful preliminary surface preparation is necessary for metal spraying. Successful operation requires air of constant pressure and volume, free from impurities and moisture. Table is given showing speed of spraying, cost, coverage and thickness for a number of commercially applied metals. Metallizing with hard coating requires rounded or continuous film around the material (easily polished), and is unsuccessful on large flat areas. WB (8e)

Metallizing Practice. V. L. SAGE. *Industry & Welding,* Vol. 8, May 1936, pages 14-17. Metal spraying applications, successful and unsuccessful, are discussed for a variety of ferrous and non-ferrous sprayed coatings such as building-up of worn and corroded shafts accomplished with alloy steel, brass piston rods with Monel to resist wear, etc. A sprayed coating of stainless steel on inside of tank was found to be stainless only when highly polished. WB (8e)

Protective Metallic Coatings by the Wire Spraying Process. W. E. BALLARD. *Transactions Manchester Association of Engineers,* 1934-35, pages 113-146. See *Metals & Alloys,* Vol. 6, Apr. 1935, page MA 156R/6. Ha (8e)

An Electrolytic Test for Zinc Coatings on Wire. S. C. BRITTON. *Journal Institute of Metals,* Vol. 58, 1936, pages 211-225. Includes discussion. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 454R/5. (8e)

The Hot-tinning of Copper: The Attack on the Basis Metal and Its Effects. EDWARD J. DANIELS. *Journal Institute of Metals,* Vol. 58, 1936, pages 199-210, plus 2 Plates. Includes discussion. See *Metals & Alloys,* Vol. 7, Aug. 1936, page MA 411L/3. (8e)

Methods of Detinning Tin Plate for Examination of the Thickness and Continuity of the Alloy Layer. A. W. HOTHERSALL & W. N. BRADSHAW. *Engineering,* Vol. 141, May 15, 1936, pages 543-544. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 455L/4. VSP (8e)

8f. Non-Metallic Coatings

To Make Paint Stick to Cadmium-Plated Steel. GEORGE A. ENDOM. *Industrial Finishing,* Vol. 12, Mar. 1936, pages 22-24, 26. Method used by author to clean Cd-plated surfaces of residue that caused paint to flake off is a 2% acetic acid treatment. Afterwards parts are washed in cold water and dried. Primer used is either oil or pyroxylin. VSP (8f)

Finishing Pressed Metal Bath Tubs and Sinks. J. B. NEALEY. *Industrial Finishing,* Vol. 12, June 1936, pages 8-11. Describes metal cleaning, spray finishing, vitreous enameling, baking ovens, gas-fired furnaces and conveyor systems at the plant of Briggs Mfg. Co., Detroit. VSP (8f)

Treatment of Galvanized Sheets for Painting. J. L. SCHUELER. *Metal Industry,* New York, Vol. 34, June 1936, pages 215-216. Galvanized surfaces must be treated artificially or by aging to secure good paint adherence whereas galvannealed sheets, which have a matte surface, need no special preparation. Any galvanized surface should be dry and free from grease, oil, or foreign material. Spangled galvanized surfaces are prepared by etching which may be either chemical or mechanical. The chemical treatments include displacement agents such as Cu and Sb salts, acids such as HCl and acetic, and aging or weathering action. Mechanical methods include scouring, abrasives and sand blasting. CBJ (8f)

Paint Films of Controlled Thickness Produced for Testing Purposes. H. G. ARLT. *Steel,* Vol. 98, June 15, 1936, pages 42, 44. See *Metals & Alloys,* Vol. 7, July 1936, page MA 358R/4. MS (8f)

9. TESTING

Correlation between Metallography and Mechanical Testing. H. F. MOORE. *Transactions American Institute Mining & Metallurgical Engineers,* Vol. 120, Iron & Steel Division, 1936, pages 13-35; Iron Age, Vol. 137, Feb. 27, 1936, pages 26-29, 106. The Henry Marion Howe Lecture delivered Feb. 1936. Discussion of subject with particular reference to influence of notches and inhomogeneities on endurance properties. JLG + VSP (9)

Non-Destructive Testing Methods in the Light of Domestic and Foreign Patent Literature (Zerstörungsfreie Werkstoffprüfung im Spiegel in- und ausländischer Patentschriften) ERNST FRANKE. *Die Wärme,* Vol. 59, Mar. 14, 1936, pages 197-203. Briefly describes radiographic, thermal, mechanical, magnetic, electrical and other non-destructive tests, emphasizing the most suitable for use in each case. WH (9)

9a. Inspection & Defects, including X-Ray Inspection

C. S. BARRETT, SECTION EDITOR

Sources of Defects in Casting and Forging of Ingots of Aluminum and Aluminum Alloys (Fehlerquellen beim Giessen und Schmieden von Blöcken aus Aluminium und Aluminiumlegierungen) W. SCHNORRENBERG. *Aluminium,* Vol. 18, Sept. 1936, pages 422-427. Defects due to incorrect melting methods, incorrect casting methods and incorrect dimensions of the chill molds are discussed and the defects occurring in these cases described by micrographs of segregation, pores, dendrites, pipes. Means to avoid defects by proper casting temperature, which influences the solubility of the metal for gases, are discussed. Ha (9a)

Metallurgy of Rail Steels. Developments in Last 25 Years. A Correlated Abstract. H. W. GILLETT. *Metals & Alloys,* Vol. 7, Oct. 1936, pages 248-249. Digest of literature on transverse fissures in rails. The relation of shatter cracks and strained conditions to the rate of cooling has been studied by many workers and the use of slow cooling from rolling is now common practice. Possible effects of H_2 and its association with "flaky" steel forgings are discussed as possibly related to shatter cracks. End batter can be taken care of by repairing by welding, by hardening rail ends or by elimination of ends by welding rails into long lengths. Rails as long as a mile are in service. Various heat treatments for increasing rail strength and fatigue resistance are discussed. 30 references. WLC (9a)

Routine Inspection of Automotive Parts. JOSEPH G. GAGNON. *Metal Progress,* Vol. 30, Sept. 1936, pages 33-38. Describes routine chemical and physical testing required in control of the quality of automotive parts. Data are given on percentage inspection applying at several preliminary stages and at final inspection. WLC (9a)

Vessels for Low Temperatures. R. K. HOPKINS. *Welding Journal,* N. Y., Vol. 15, Sept. 1936, pages 16-19. Properties and testing methods to qualify materials for welded pressure vessel use at —40° to —75° F. Impact testing is essential and Charpy keyhole notch sample provides most consistent results. WB (9a)

Recent Apparatus and Methods for Surface Testing (Neuere Geräte und Verfahren zur Oberflächenprüfung) F. PACHTNER. *Oberflächentechnik,* Vol. 13, Sept. 15, 1936, pages 207-208. Various optical and mechanical testing methods are described. 8 references. Ha (9a)

Controlled welding: Applications in Boiler Making (La Soudure Controlée. Quelques-unes de ses Applications en Matériel de Grosse Chaudronnerie) RAYMOND LEMAIRE. *Bulletin de la Société des Ingénieurs-Soudeurs,* Vol. 7, Jan.-Feb. 1936, pages 2054-2068. Lecture before the French Welders' Society. See *Metals & Alloys,* Vol. 7, Oct. 1936, page MA 502R/6. FR (9a)

Weight Reductions Emphasize Benefits of Radiographic Casting Exploration. E. B. PERRY. *Iron Age,* Vol. 137, Apr. 30, 1936, pages 33-36. Cutting up castings to locate defects is costly for it makes the castings useless. Better and more economic methods are the X-ray or the gamma-ray. Gamma-ray is coming into greater use because castings are being reduced in weight and are more intricate. Gives method of procedure in the use of gamma-ray, in detail. VSP (9a)

9b. Physical & Mechanical Testing

W. A. TUCKER, SECTION EDITOR

Direct-Reading Hardness Testing Machine. *Engineer,* Vol. 161, June 26, 1936, page 687. Describes a hardness testing machine to give direct reading when used on thin brass or other metals, often of complicated shape. It is made by the National Armament Works, Herstol, Belgium. Degree of hardness is given by penetration of 2 opposed points between which test piece is gripped. Reading gives the sum of depth of 2 penetrations opposite to one another, and measures the mean hardness of the opposite faces. Includes a calibration curve in relation to Brinell numbers. VSP (9b)

The Testing of Sorbitic Steel Rails. *Engineering,* Vol. 141, June 19, 1936, pages 666-667. Describes the regulated sorbitic process and tests developed by Messrs. Sandberg. Tests comprise a tensile test conducted on small test pieces cut from rail head and close to running surface, and crossed-prism pressure test. Two prisms are placed apex to apex at 90° angle and subjected to a load of 30 tons in hydraulic press. Composition of steel rails tested was: C 0.49%; Si 0.122%; Mn 1.00%; S 0.038%; and P 0.041%. Tabulates results of tests. VSP (9b)

International Unification of the Depth of the Notch cut in Impact Test Pieces (Sulla unificazione internazionale della profondità d'intaglio nella provetta di resilienza) S. MENGHI. *La Metallurgia Italiana,* Vol. 28, Aug. 1936, pages 365-384. While the 10 x 10 x 55 test-piece has been generally adopted in Europe, there is still disagreement as to the preferred depth of the notch to be cut. Menghi finds that the 2 mm. cut gives more consistent results than the 5 mm. cut. He also calls attention to the excellent results obtained with a test-piece 10 x 14 x 55 with a 2 mm. notch cut on 3 sides. AWC (9b)

Further Tests on the Effect of Time in Testing. H. QUINNEY. *Engineer,* Vol. 161, June 26, 1936, pages 669-673. Includes references. Object of tests has been to compare load extension diagram for metals tested under varying conditions with regard to time. Tensile and torsional, quenching and tempering tests were conducted and results are given. Cast and mild steels and Yorkshire Fe were used. Gives a number of load extension diagrams for the different metals. VSP (9b)

Behavior in, and Rate of, Elongation of Metals under Static Tensile Stress (Ueber den zeitlichen Verlauf der Dehnung und der Dehngeschwindigkeit von Metallen unter ruhender Zugbelastung) A. POMP & W. LÄNGE. *Mitteilungen aus dem Kaiser-Wilhelm-Institut für Eisenforschung,* Vol. 18, 1936, pages 51-63. Exact tests are described to follow the course of elongation and to determine the rate of elongation in creep tests with Cu, Zn and Pb. The velocity of elongation depends on temperature and on grain size, for both factors curves are shown. The possibility of reducing the time for creep tests with proper consideration of the factors involved seems to be given for routine tests where absolute accuracy is not required; otherwise long time tests always should be made. 35 references. Ha (9b)

German Hardness Testing Machines and Appliances. G. RICHTER. *Engineering Progress,* Vol. 12, Apr. 1936, pages 81-86. Modern viewpoints for hardness testing and static and dynamic testing methods are discussed and a few modern apparatus described. Ha (9b)

Wire Ropes. WALTER A. SCOBLE. *Journal & Record of Transactions Junior Institution of Engineers,* Vol. 46, Apr. 1936, pages 327-340. Paper delivered in London, Feb. 23, 1936, briefly discusses materials and construction of wire ropes and then considers at great length the various testing methods utilized for wire rope material and finished ropes, such as bending, repeated bending, spring tensioning, hydraulic tensioning machines. Experimental evidence is presented in various diagrams correlating (1) rope tension and bends to failure, (2) tensile and bending stress and number of bends to failure, (3) tension/tensile strength and number of bends to failure, (4) increasing pulley diameter and number of bends to failure, (5) ratio of rope tension and tensile strength, ratio sheave diameter to rope circumference for a fixed number of bends (¼ million) of ropes of differing construction. WH (9b)

New Standards for Railroad Boiler Steel. T. VLADIMIRSKII. *Stal,* Vol. 6, Jan. 1936, pages 54-57. In Russian. The author recommends modifying the existing Russian standards by increasing the minimum tensile strength from 33 to 36 kg./mm.^{2}, substituting a sliding scale for elongation in place of the fixed value of 26%, and introducing the Charpy impact test. HWR (9b)

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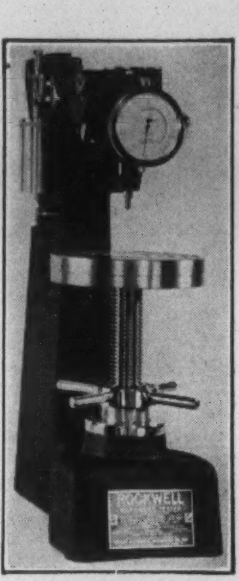

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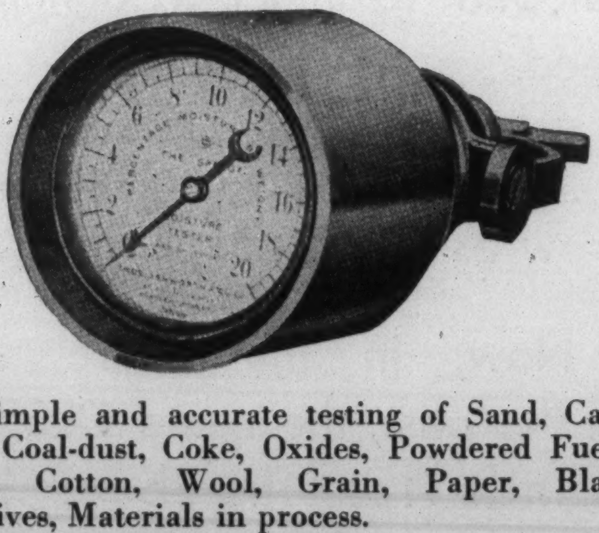

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A Bend Test for Tinplate. C. C. WILLITS. *Metal Progress*, Vol. 30, Sept. 1936, pages 50-55. Describes machine for repeated bending and unbending of tinplate to 90° angle. Clamping device is designed to bend the tinplate about a radius equal to its thickness. The lower clamp is turned by means of a hand worm while the upper clamp acts against a weighted pendulum. An autographic attachment records the relation of angle of bend and load due to the pendulum. Curves show yielding as load decreases and as bending is repeated until failure occurs. The test reveals any tendency to transverse weakness. When curves of bending and unbending cycle enclose practically the same area it indicates same capacity to resist unbending as to resist original bending.
WLC (9b)

The Preparation of Cast Iron Transverse Test Bars. A. I. KRYNITSKY & C. M. SAEGER, JR. *Engineering*, Vol. 142, July 17, 1936, page 59; *Mechanical World & Engineering Record*, Vol. 100, July 3, 1936, page 9. See "An Improved Method for Preparing Cast Iron Transverse Test Bars," *Metals & Alloys*, Vol. 7, Sept. 1936, page MA 457L/4. VSP + WH (9b)

Effects of High Shearing Stress Combined with High Hydrostatic Pressure. P. W. BRIDGMAN. *Physical Review*, Vol. 48, Nov. 1935, pages 825-847. Mean hydrostatic pressures up to 50,000 kg./cm.^{2} combined with shearing stresses up to the plastic flow point are produced in thin disks confined between hardened steel parts so mounted that they may be subjected to normal pressure and torque simultaneously. Qualitative and quantitative studies are made of the effects of such stresses. Among the qualitative effects it is found that many substances normally stable become unstable and may detonate, and conversely combinations of substances normally inert to each other may be made to combine explosively. Quantitatively, the shearing stress at the plastic flow point may be measured as a function of pressure. The shearing stress at plastic flow may rise to the order of 10 or more times greater at 50,000 kg./cm.^{2} than it is normally at atmospheric pressure; this is contrary to the usually accepted results in a narrower range of pressure. If the substance undergoes a polymorphic transition under these conditions of stress, there may be a break in the curve of shearing stress vs. pressure. This gives a very convenient tool for the detection of transitions. 57 elements have been explored in this way, and a number of new polymorphic transitions found. WAT (9b)

9c. Fatigue Testing

H. F. MOORE, SECTION EDITOR

The abstracts appearing under this heading are prepared in cooperation with the A.S.T.M. Research Committee on Fatigue of Metals. The purpose of this cooperation is to make readily available complete references to the literature of this subject. The Committee does not necessarily subscribe to the statements of either the author or the abstractor.

Criticism of Short Time Methods for Determining the Endurance Limit (Kritik der Kurzzeitverfahren zur Bestimmung der Dauerwechselfestigkeit) W. SPATH. *Metallwirtschaft*, Vol. 15, July 31, 1936, pages 726-729; Aug. 7, 1936, pages 750-752. The methods of estimating the endurance limit by dynamic stress-strain curves and by measurements of damping capacity are analyzed in terms of a previously described model. It is shown that previous to the tests the material should be subjected to a static load to eliminate extraneous effects. GD (9c)

Difference between Surface-pressing and Pressing with three-dimensional Pressure in Effect on Endurance (Der Unterschied zwischen Oberflächendrücken und Drücken mit allseitigem Druck in bezug auf Dauerhaltbarkeit eines Werkteils) O. FÖPPL. *Mitteilungen des Wöhler-Instituts*, No. 29, 1936, pages 57-60. Discussion of previous data on the beneficial effect of cold-working the surface of a metal by rollers under high pressure, and the data of Löhr, showing that 3-dimensional pressure (which does not cause permanent deformation) is without effect. Föppl's idea is that in the former case tiny cracks on the surface are burnished down and cold-welded, while in the latter they are not. He believes that cold-working the surface is much the same as what goes on in the process of strengthening by understressing. Since the cold working of the surface is even more effective when the specimen is subjected to corrosion-fatigue than in a test in air, he does not believe it is a matter of the introduction of stress. (The increase in surface hardness resulting from surface-working, and from strengthening by understressing in a specimen stressed more highly on the surface than in the interior, is not mentioned by Föppl.) HWG (9c)

9d. Magnetic Testing

Nonorthogonality and Ferromagnetism. J. H. VAN VLECK. *Physical Review,* Vol. 49, Feb. 1936, pages 232-240. The calculations in Heisenberg's theory of ferromagnetism have been questioned by Inglis and others on the ground that the error resulting from the nonorthogonality of the wave function may possibly increase without limit when the number of atoms becomes arbitrarily large. In the present paper it is proved that this difficulty does not really arise. Semiquantitative formulas are given to correct for the error due to nonorthogonality. A supplementary note is included on a new method of approximating the partition function in Heisenberg's theory. WAT (9d)

Magnetization of Nickel Under Compressive Stresses and the Production of Magnetic Discontinuities. C. W. HEAPS. *Physical Review,* Vol. 50, July 1936, pages 176-179. When Ni is compressed its hysteresis loop approaches a rectangular shape. Several curves for stresses increasing up to the elastic limit have been obtained. At the maximum stress the steep part of the loop is still not vertical and the Barkhausen effect is not appreciably changed by the pressure. Much smaller stresses in an elastically bent wire produce large magnetic discontinuities, hence the existence of contiguous compressed and stretched regions appears to be necessary for the production of the large discontinuities. WAT (9d)

A Convenient Primary Winding for Magnetic Testing of Rings in Low and Intermediate Fields. C. G. DUNN. *Review of Scientific Instruments,* Vol. 7, Sept. 1936, page 359. Describes a permanently assembled primary winding easier to apply to a number of magnetic test rings than the usual solenoid winding. RWD (9d)

Fault Detection in Metals by Magnetic Methods. *Engineering,* Vol. 141, May 8, 1936, pages 504-505. Defects in articles made of Fe and its alloys can be detected before machining, or after a period in service, by the magnetic powder methods, such as have been developed by Metropolitan-Vickers Electric Co. The methods depend on the fact that the susceptibility of a fault is markedly inferior to that of the surrounding material. A magnetic flux is passed through an article so that the direction of flow is at right angles to fault. It will seek an alternative path round the fault and will suffer a distortion and extend round the discontinuity into the air spaces outside. Describes the several methods available for detecting transverse faults in rails and rolled stock, and surface cracks due to grinding or quenching. VSP (9d)

The Theory of Magnetism. Contemporary Advances in Physics. XXX. KARL K. DARROW. *Bell System Technical Journal,* Vol. 15, Apr. 1936, pages 224-247. This article aims to put in as clear and understandable form as possible, the modern atomic theory of magnetism. Without recourse to any involved mathematics the author shows how magnetism of matter may be explained by the magnetic moments which electrons, atoms, and molecules must have by virtue of the atomic structure deduced from spectroscopy. For paramagnetic substances the magnetic moment deduced from magnetization curve data agrees very well with that furnished by spectroscopy and other means. It is possible, to some extent, to apply the same analysis to ferromagnetic substances but not enough is known yet about the nature of the tremendous exchange forces causing permanent magnetism in large volumes of substance, to allow a complete theory to be drawn up. Diamagnetism is due to the gyroscopic precession of the atomic magnet about the field direction and may be interpreted and evaluated from existing facts about atomic structure. HFK (9d)

9e. Spectrography

L. W. STROCK, SECTION EDITOR

Spectrograph for Rapid Industrial Application. M. F. HASLER & R. W. LINDHURST. *Metal Progress,* Vol. 30, Sept. 1936, pages 59-63, 90. Describes a grating spectrograph and accessories for rapid analysis. A complete qualitative analysis for all elements is a matter of ½ hr. Quantitative analysis to the nearest power of 10 may be made in one exposure. Accuracy is about 90%. WLC (9e)

Practical Apparatus for Spectroscopic Chemical Analysis. I. An electrode Stand of Improved Design. JOHN L. GRING & GEORGE L. CLARK. *Review of Scientific Instruments,* Vol. 7, Aug. 1936, pages 305-306. A design is shown of a new type of electrode stand which accommodates 4 pairs of electrodes simultaneously. Any pair of these can quickly be brought to the exposure position. The stand can be used either for arc or spark emission spectrum. RWD (9e)

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10. METALLOGRAPHY

J. S. MARSH, SECTION EDITOR

Age-hardening of Aluminum Alloys, I—Aluminum-copper Alloys. William L. Fink & Dana W. Smith. *Metals Technology, American Institute Mining & Metallurgical Engineers Technical Publication* No. 706, June 1936, 10 pages. An Al alloy containing 5.17% Cu, 0.01% Si and 0.01% Fe was rolled into sheet. Specimens of this sheet were heated for 20 hr. at 540° C., quenched in cold water and subsequently aged at various temperatures for various times. The aged specimens were examined microscopically, their lattice parameters determined by the back-refiction method, and tested as tensile specimens. Lattice parameter was not changed by precipitation of minute particles during age hardening as it is by precipitation under equilibrium conditions. Precipitation can be observed microscopically before the aging has progressed far enough to change the yield strength and elongation substantially. The anomalous changes in density can be explained by particle size or by the precipitation of a transition phase (Θ') which has been identified by Wassermann and Weerts and confirmed by the authors. It is concluded that there seems to be no justification for modification or complication of the theory of precipitation hardening advanced by Merica, Waltenberg, and Scott. 13 references. JLG (10)

Isothermal Transformation of Austenite in Chromium-molybdenum Structural Steels. M. M. Kantor & E. V. Radzievskaia. *Kachestvennaia Stal,* Vol. 4, No. 6, 1936, pages 25-30. In Russian. Isothermal transformation in a 0.35% C, 0.19 Si, 0.98 Cr, 0.18 Ni, 0.76 Mn, 0.21 Mo was investigated in a new dilatometer (described). Results obtained were applied to heat treatments of sheets of the same material which were done by quenching and drawing and by isothermic transformation. The latter produced higher tensile strength and almost doubled elongation. (10)

Application of the Polarizing Microscope in the Investigation of Steel and Iron (Ueber die Anwendung des Polarisationsmikroskopes bei der Untersuchung von Stahl und Eisen) Niaz Ahmad. *Forschungsarbeiten über Metallkunde und Röntgenmetallographie,* No. 15, 1934, 37 pages. After light etching, the orientation of the grains in pearlite can be readily observed by polarized light. Slip lines are also observable in polarized light. Under crossed nicols, pearlite containing inner stresses is brighter than when stress free, the specimens being etched. Direction of flow in cold deformation can be determined by examination in polarized light. The application of polarized light in study of slag and other inclusions, graphite, and compounds in ferro-alloys is shown. 33 references. JLG (10)

Checking Grain Size in Automobile Steels. N. F. Bolkhovitinov & I. S. Kozlovski. *Kachestvennaia Stal,* Vol. 4, No. 6, 1936, pages 7-16. In Russian. Detailed description of the methods used for determination of austenitic grain size in steel—including carburization, normalization, fracturing quenched specimens as the common methods—and magnetic measurements and dilatometric changes as newer ones. (10)

Coefficient of Equivalence of Iron with Respect to Aluminum in Aluminum Bronze. J. L. Bray, M. E. Carruthers & R. H. Heyer. *Metals Technology, American Institute Mining & Metallurgical Engineers Technical Publication* No. 702, June 1936, 10 pages. Cu-base alloys containing between 9 and 16% Al, and as much as 4.5% Fe were prepared, some by adding Fe as the element and others by adding Cu to the desired Al-Fe alloy. Specimens were heat treated and examined microscopically to determine influence of Fe on phase relationships in solid Cu-Al alloys. Fe in amounts up to 4%, whether added as metallic Fe or Fe-Al alloy, did not alter the Cu-Al solid-solution relationships of cast alloys. The presence of Fe up to 4% hastens materially the speed of the eutectoid transformation on cooling. Fe up to 4% has very little influence on eutectoid temperature. 6 references. JLG (10)

Equilibrium Relations in Aluminum-magnesium Silicide Alloys Containing Excess Magnesium. F. Keller & C. M. Craighead. *Metals Technology, American Institute Mining & Metallurgical Engineers Technical Publication* No. 707, June 1936, 9 pages. Microscopic examination of heat-treated alloys showed that in Al-base alloys an excess of Mg over that required to form Mg_2Si with all of the Si present decreased the solid solubility of Si at all temperatures. As the Mg is increased the solubility of Mg_2Si at the quenching temperature becomes so small that useful hardening can not be brought about by quenching and aging. Wrought Al-Mg_2Si alloys containing an excess of Mg are therefore of little commercial importance. JLG (10)

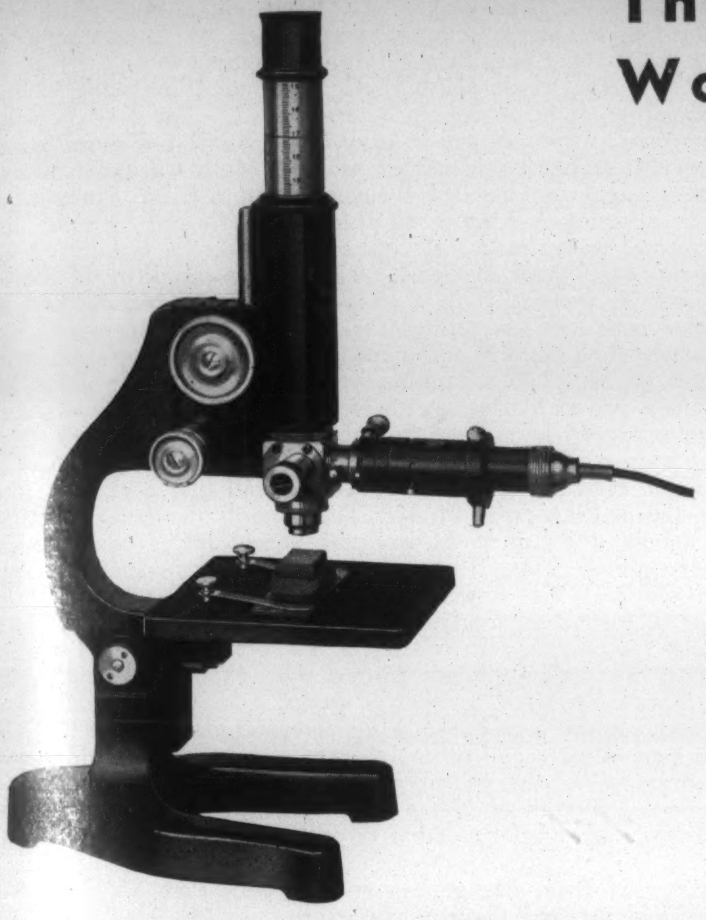
Density Changes in Solid Aluminium Alloys. L. W. Kempf & H. L. Hopkins. *Aluminium & the Non-ferrous Review,* Vol. 1, June 1936, pages 405-412. See *Metals & Alloys,* Vol. 7, July 1936, page MA 363L/4. JCC (10)

Chromium-manganese and Chromium-manganese-nickel Stainless Steels. F. F. Khimushin & O. I. Kurova. *Kachestvennaia Stal,* Vol. 4, No. 6, 1936, pages 16-25. In Russian. A large number of steels belonging to 12% Cr-5% Mn, 15% Cr-12% Mn and to 12% Cr-8% Mn types with and without Ni additions and C variation were studied in detail to develop a steel suitable for aviation uses. The first group is martensitic after rapid cooling from 1150° C. unless 6-7% Ni is added. After the same treatment a steel with 0.37% C, 0.24 Si, 8.90 Mn, 12.4 Cr, 4.13 Ni had 121,750 lbs./in.^{2} tensile strength, with 56% elongation, being entirely austenitic. It worked well both hot and cold. When to a steel containing 15% Cr and 12% Mn is added 0.32-0.42% C, its structure after quenching from 1150° C. becomes entirely austenitic. With lower C content ferritic areas are present, with higher, formation of complex carbides is observed. Best results in this series were obtained with a steel containing: 0.32 C, 0.13 Si, 12.6 Cr. Its tensile strength after a 1150° C. quench was 118,000 lbs./in.^{2} and elongation 36.5%. Semi-commercial heats made with 0.30 C, 0.8 max. Si, 8.0% Mn, 12% Cr and 4% Ni produced entirely satisfactory strip free from intercrystalline attack. After heating at 500°-900° C. all steels investigated had a pronounced intercrystalline attack. (10)

Decomposition of Solid Solutions of Copper in Aluminum Resulting from Plastic Deformation Followed by Annealing (Ueber den Zerfall der festen Lösung von Kupfer in Aluminium als Folge plastischer Deformation mit nachfolgendem Anlassen) S. Konobejewsky & M. Sacharowa. *Metallwirtschaft,* Vol. 15, May 1, 1936, pages 412-417. The time and temperature dependence of the decomposition of solid solutions of 2, 4, and 5% Cu in Al is followed by lattice parameter measurements. Equilibrium conditions are followed closely in undeformed material, though the usual induction period is observed and some supersaturation persists in the 2% alloy. When the sample is deformed, as in preparation of powder specimens by filing, a large amount of precipitation occurs immediately at room temperature but a definite supersaturation persists. The precipitation is attributed to internal stresses introduced by the filing, while the supersaturation is described as an equilibrium condition determined by the size of the $CuAl_2$ particles, which are accordingly very small when supersaturation is greatest. G D(10)

Contact Potential Difference between Single Crystal Surfaces of different Orientation. I. (ontaktpotential Differenzen zwischen Einkristallflächen verschiedener Orientierung. I) H. Kurze & J. Rottgardt. *Zeitschrift für Physik,* Vol. 100, June 3, 1936, pages 718-725. A contact potential difference between 111 planes of a single Bi crystal was found to be +0.36 volts. FHC (10)

Preferred Orientations Produced by Cold-rolling Low-carbon Sheet Steel. M. Gensamer & R. F. Mehl. *Metals Technology, American Institute Mining & Metallurgical Engineers, Technical Publication* No. 704, June 1936, 14 pages; *Transactions American Institute of Mining & Metallurgical Engineers,* Vol. 120, *Iron & Steel Division,* 1936, pages 277-292. Sheet bar of mild steel ¼" thick was rolled to a reduction of 95%, samples being taken for every 5% reduction after 30% reduction. X-ray diffraction data were obtained from the rolled material and plotted as pole figures. The preferred orientation (texture) developed gradually with reduction, approaching more nearly a state of complete orderliness of orientation of all crystals. There is no change in type of preferred orientation during the course of rolling. It is shown that a zonal texture exists in cold-rolled mild steel with the outside layer exhibiting a modification of the texture developed at the center of the sheet. The texture of the outside of the sheet gives rise to a 6-point diagram in a normal pinhole photogram, whereas the inside produces a 4-point diagram. Pole figures indicated that the texture developed for the inside of the sheet is the same as that described by Kurdjumow and Sachs and discussed by Wever. The texture of the inside can be accounted for by mechanisms of formation already discussed, but that of the outside can not be explained so readily. Conditions during rolling that give rise to the difference in texture between inside and outside are yet to be explained. 7 references. JLG (10)



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Equilibrium Relations in Aluminum-zinc Alloys of High Purity, II. WILLIAM L. FINK & L. A. WILLEY. *Metals Technology, American Institute Mining & Metallurgical Engineers Technical Publication* No. 705, June 1936, 17 pages. Solid solubility of Zn in Al was determined by electric-resistance methods and by microscopic examination. Alloys were made from electrolytically refined Al and triple-distilled Zn. Solubility of Zn in Al was found to increase from 5.4% at 125° C. to 31.6% at 275° C., then suddenly increase to 77.7% and slowly increase to 81.4% at 350° C. A solubility gap in the Al solid solution extends from 31.6 to 77.7% Zn just above 275° C. At higher temperatures the solubility gap narrows and finally disappears at 353° C. and 60% Zn. 8 references. JLG (10)

Twinning and Flowing in the Extruding of Aluminum Alloys (Zweiwachs und Fliessvorgang beim Strangpressen von Aluminium-Legierungen) W. GELLER. *Aluminium,* Vol. 8, Aug. 1936, pages 349-353. Twinning occurs in the extruding process if, towards the end of the process, impurities migrate from the surface of the block to be extruded into the interior of the extruded rod and there cause separation. Twinning is due to flow phenomena taking place within the extrusion block. The occurrence of such twinning observed in extruding of an Al alloy to 12 mm. wires was investigated and the structure determined longitudinally; the sections clearly show accumulations of oxides and crystals of the alloying elements in the twinning zone. Ha (10)

Microstructures of the Metastable γ'-Phase in Cu-Al Alloys (Kleingefüge der mestabilen γ'-Phase von Cu-Al-Legierungen) V. GRIDNEW & G. KURDJUMOW. *Metallwirtschaft,* Vol. 15, May 8, 1936, page 437. Thin samples of Cu with 14% Al were quenched from 900° to show the γ' phase alone, and from 790° to show $\gamma + \gamma'$, as confirmed by X-rays. In both cases the γ' appears as needles, similar to those of β', but is also featured by twins. GD (10)

Aging and Hardening of Metallurgical Products (Vieillissement et Trempe structurale des Produits Mètallurgiques) L. GUILLET. *Cuivre et Laiton,* Vol. 9, Aug. 30, 1936, pages 367-369. A brief review of materials which can be hardened and aged by heat treatment and the structural changes connected with the process. Ha (10)

Selecting and Heat Treating Steels for Making Gears. JOHN T. HOWAT. *Steel,* Vol. 98, May 4, 1936, pages 44, 46. From a paper read before the American Gear Manufacturers' Association, Oct. 1935. See "Studying Gear Steels with the Microscope," *Metals & Alloys,* Vol. 7, June 1936, page MA 310L/1. MS (10)

Nature of Peritectic Reaction and Mechanism of Grain Refinement Resulting therefrom. KEIZO IWASE, JUN ASATO & NOBUYUKI NASU. *Kinzoku no Kenkyu,* Vol. 13, June 1936, pages 213—222. In Japanese. The nature of the so-called peritectic reaction has been studied from the standpoint of heterogeneous equilibrium and it was concluded that (1) in an ideal case the secondary crystal formed by the reaction between the primary and the melt does not wrap the primary because it is not easy for the reaction to proceed further, (2) the primary crystal disintegrates by the reaction which corresponds to the increase of the surface of contact between the primary and the melt, (3) disintegrated fragments of the primaries have different orientations and behave as nuclei of the secondary. These conclusions have been satisfactorily proved by the investigation of the structures of Sb-Sn-Pb alloys and the phenomenon of grain refinement by the peritectic reaction was explained from this standpoint. It was suggested that in some cases an enlargement of the grain size may be encountered by the peritectic reaction. From the same standpoint, the process of "Umhüllung" observed in the case in which the solid solution crystallizes from melt has been clearly explained. The "Umhüllung" and the wrapping of the primary by the secondary are considered to be met in cases in which an apparent equilibrium is established. KT (10)

The Theory of Alloy Structures. W. L. BRAGG. *Journal Royal Aeronautical Society,* Vol. 39, June 1935, pages 409-413. A general discussion of the application of X-ray analysis to the study of crystal structure is presented. The mechanism of diffraction and the technique of X-ray analysis are outlined, and the correlation between observed X-ray data and several physical properties of metals is indicated. The parallelism between the new knowledge and classifications yielded by X-ray studies, and the replacement of classical mechanics by the new electronic energy-level mechanics of the theoretical physicist is discussed, and reference is made to H. Jones' application of the "new mechanics" to the explanation of Hume-Rothery's empirical alloy phase rule. FPP (10)

Study of Crystal Orientation in Sheets by Means of Their Elastic Properties. A. E. BRYUKHANOV. *Metallurg,* No. 3, 1936, pages 60-67. In Russian. Re-orientation in space of crystallographic axes of crystals takes place simultaneously with slipping when the metals are plastically deformed. With a high amount of cold deformation this leads to preferred orientation. Crystals of all metals are anisotropic, which is reflected in different properties along varying crystallographic planes. Modulus of elasticity varies, for example, from 13,500 kg./mm.^{2} for (100) plane to 29,000 kg./mm.^{2} along (111) plane. The study of its variations gives an approach to some phenomena occurring in metals under specific conditions. Expressions for modulus of elasticity of Fe for (100), (110) and (111) planes were decomposed into Fourier series. Along (100) and (110) planes the modulus of elasticity can be represented as sums consisting of a free member and a series of harmonics having periods of π, $\frac{\pi}{2}$, $\frac{\pi}{3}$ and $\frac{\pi}{4}$. Each plane is characterized by corresponding harmonics and the ratios of their amplitudes. This permits their separation from each other. Along the octahedral planes the modulus of elasticity of steel is constant, i.e. the material is isotropic. Harmonic analysis of modulus of elasticity is a convenient and sensitive tool for the study of orientation. When applied to sheet material it permits the determination of slight preferred orientations and crystallographic changes taking place. It permits identification of preferred orientation even in the case when only some planes of crystals are similarly oriented while their crystallographic direction is random. Modulus of elasticity was determined by means of vibrating rod method, a description of which is given. Harmonic analysis was applied to the study of steel plate in the as-rolled condition as well as annealed at 700° and 900° C. (10)

The Problem of Gas in Metals (Le Problème des Gaz dans les Métaux) G. CHAUDRON. *Revue de Fonderie Moderne,* Vol. 30, Feb. 10, 1936, pages 35-39. See *Metals & Alloys,* Vol. 7, Aug. 1936, page MA 414R/7. Ha (10)

Foundry Products Through the Microscope. E. B. ELLIS. *Foundry Trade Journal,* Vol. 54, Apr. 23, 1936, pages 319-322.

The Application of X-rays to Metallurgy. HUBERT PLANT. *Metallurgia,* Vol. 14, July 1936, pages 71-73; Aug. 1936, pages 101-103; Sept. 1936, pages 121-122. Discusses principles of X-rays and their diffraction. Part III deals with practical side of subject, giving attention to apparatus and results obtainable. JLG (10)

The Structure of Electrolytic Chromium. L. WRIGHT, H. HIRST & J. RILEY. *Transactions Faraday Society,* Vol. 31, Sept. 1935, pages 1253-1259. Discussion begins on page 1259. The existence of the hexagonal modification of Cr in deposits obtained from chromic acid solutions was confirmed. Interatomic distance was 2.717 A.U. The axial ratio was 1.626. The hexagonal form was converted to the body-centered cubic on heating *in vacuo* at 300° C. for 1½ hours. The value of the lattice constant with such heat treated structure was 2.8788 A.U. as compared with 2.8781 A.U. obtained for a sample of commercial Cr of 99.15% purity. The feature influencing the formation of the hexagonal allotrope is the percentage of Cr existing in the cation in reduced chromic acid solutions. In a solution containing 175 g./l. CrO_3, 0.075 *N* SO_4 with a current density of 10.75 amps./dm.^{2} at a temperature of 16° C. the hexagonal structure was obtained if the % Cr in the cation were above 20% and only the body-centered cubic if below 16% and both modifications were obtained when the % Cr was 18.7. 16 references. PRK (10)

X-Rays and Atoms. An Industrial Review. ROBERT C. WOODS. *Metals & Alloys,* Vol. 7, July 1936, pages 181-184. WLC (10)

Nitrogen Absorption in Grinding of Soft Iron (Stickstoffaufnahme beim Schleifen von weichem Eisen) H. J. WIESTER. *Technische Mitteilungen Krupp,* Vol. 4, June 1936, pages 80-82. See *Metals & Alloys,* Vol. 7, Aug. 1936, page MA 414L/6. Ha (10)

Untenability of the Conception of Lower and Upper Limit of Elasticity, and Investigation of Load at Break of Mild Steel and Other Metals (L'insostenibilita del concetto di limite di snervamento superiore e inferiore, e considerazioni sul carico di rottura dell'acciao dolce e di altri metalli) G. WELTER. *La Metallurgia Italiana,* Vol. 28, May 1936, pages 219-224. See *Metals & Alloys,* Vol. 7, Apr. 1936, page MA 198R/4. AWC (10)

Correlation of the Bronzes (Zur Systematik der Bronzen) F. WEIBKE. *Metallwirtschaft,* Vol. 15, Mar. 27, 1936, pages 299-307; Apr. 3, 1936, pages 321-325. Equilibrium diagrams of Cu with Be, Mg, Zn, Cd, Hg, Al, Ga, In, Tl, Si, Ge, Pb are arranged according to the position of the addition element, M, in the periodic table, accompanied by a bibliography and a brief historical survey of their study. New thermal, microscopic, and X-ray studies were made on 18 Cu-Ge alloys containing 14.4 to 31.7 at. % Ge. The solid solubility of Ge in the α phase at 700° is 11.7%, decreasing to 11.1% at 400°. A γ phase forms at 746° by the peritectic reaction, $\beta + \text{melt} \rightarrow \gamma$, containing from 18.7 to 24.3% Ge, with a eutectoid decomposition, $\gamma \rightarrow \beta + \epsilon$ at 570°. The single phase Cu_3Ge is found to be stable at room temperature, transforming to δ above 612°. The $\delta + \Theta$ eutectic is at 640°. Both β and ϵ have close-packed hexagonal lattices. Generally an appreciable solid solution M in Cu exists, but this is very slight for the heavy elements Hg, Tl, Pb. Intermetallic phases showing melting point maxima, or formed by solid transformations or peritectic reactions are general, the maxima existing only for the lighter elements. The greater simplicity of the Hg, Tl, and Pb systems is in agreement with the generalization that in the same periodic group the stability of the compounds, as shown by their heats of formation, decreases with increasing atomic weight of M. The separation of the liquidus and solidus lines for the α phases increases with increasing atomic weight of M and is accompanied by a lowering of the horizontal terminating the solidification of the α phase. The solid solubility of Cu in the phase terminal with M is in general small and a eutectic forms near the melting point of M. The change of atomic volume of Cu due to addition of M is linear within the α phase and the corresponding change for the addition element increases sharply with valence. The systems with Be, Mg, In, Si, which show decrease of α solid solubility, all age harden except Si, which has an atomic volume similar to that of Cu. The Cu to M ratio is smallest for the compounds formed with M of the second group and largest for M of the fourth group. In general the β phases are body centered cubic, showing eutectoid decomposition. They form super-lattices and other intermediate phases on rapid cooling and only follow the equilibrium diagram on slow cooling. The structural analogies of Hume-Rothery are for the most part valid, Cu_5Si and Cu_4In being notable exceptions. GD (10)

Alloys of Iron, Manganese and Carbon. Part XV. The Ternary Diagram and General Summary. F. M. WALTERS, JR. & CYRIL WELLS. *Transactions American Society for Metals,* Vol. 24, June 1936, pages 359-374. Summary of data previously reported on these alloys and the ternary diagram. 25 references. WLC (10)

On Naming the Aggregate Constituents in Steel. J. R. VILELLA, G. E. GUELLICH & E. C. BAIN. *Transactions American Society for Metals,* Vol. 24, June 1936, pages 225-261. See *Metals & Alloys,* Vol. 7, June 1936, page MA 311. WLC (10)

Study of Replacement Reaction $PbS + Fe \rightleftarrows FeS + Pb$ by Means of Thermal Analysis of the Ternary System Fe-Pb-S. G. G. URAZOV, P. A. VOROB'EV & YA. V. AINBINDER. *Metallurg,* No. 2, 1936, pages 9-26; No. 3, 1936, pages 15-27. In Russian. A comprehensive investigation. Fusion diagram of the ternary system Fe-Pb-S shows that the replacement reaction $PbS + Fe \rightleftarrows FeS + Pb$ proceeds at high temperatures from left to right not to completion. A reaction in opposite direction is appreciable. Pb replacement from its S compounds with Fe belongs to reversible reactions. From analysis of 2 superimposed layers forming in Fe-Pb-S system and from the solubility curve of Pb in the upper layer equilibrium constants for the system $PbS + Fe \rightleftarrows FeS + Pb$ were determined. This constant drops rapidly with temperature increase. The type of fusion isotherms indicates that in cases when free Pb settles down it has a pronounced influence on the changes in the matte layer. (10)

Iron-tungsten System (Beiträge zur Kenntnis des Systems Eisen-Wolfram) OTTO LANDGRAF. *Forschungsarbeiten über Metallkunde und Röntgenmetallographie,* No. 12, 1934, 46 pages. Previous work on the system is reviewed. Alloys were made by melting in a small indirect-arc furnace and studied by microscopic and X-ray methods. Only 3 phases were found: Fe, Fe_3W_2, and W. Microscopic examination indicated that the solid solubility line of W in Fe intersected the eutectic line at 23% W and that the eutectic is at 33% W. X-ray studies indicated that the solubility of W in Fe below 600° C. is vanishingly small. In disagreement with Arnfelt and Takeda, the compound Fe_3W_2 was found not to be trigonal but hexagonal with $a = 4.73$ A. U. and $c = 7.70$ A. U. X-ray studies also showed that Fe_3W_2 dissolved almost no Fe or W. The upper limit of existence of the compound was found to be 1675° C. In alloys from 55 to 68.3% W 2 types of compound appeared to form, but X-ray diffraction patterns showed that they were crystallographically identical. Takeda's "X" phase could not be confirmed. Even at high temperatures W dissolved almost no Fe. JLG (10)

Recrystallization of Non-killed, Soft Ingot Iron and of a Completely Deoxidized Izett Steel (Ueber die Rekristallisation von unberuhigtem, weichem Flusseisen und einem völlig desoxydiertem Izettstahl) W. TOFAUTE & V. LWOWSKI. *Technische Mitteilungen Krupp,* Vol. 4, June 1936, pages 66-74. The relations between grain size of differently deoxidized steels are reviewed and the influence of normal annealing and of overheating on the grain size of castings which were deoxidized to different degrees was investigated. General conclusions of the experiments are that after normal annealing at 930° C. the ingot Fe showed a 2 to 4 times larger grain than the 2 entirely deoxidized Izett steels. Overheating at 1100° C. does not change the grain size (obtained at 930° C.) while that of the ingot Fe increases 25%. When rolling, the hardness of the ingot Fe increases about twice that of Izett due to aging. The recrystallization depends largely on pretreatment, the difference in grain size due to the manufacturing process is, however, maintained in subsequent heat treatments (recrystallization processes). For both materials a critical annealing temperature was found for the first recrystallization, which critical interval enlarged in the second recrystallization to such extent that even a deformation of 5% and annealing at 725°-750° C. was sufficient to produce the same coarse grain as was obtained otherwise with a 10-15% cold rolling. The conditions are illustrated by micrographs and curves. 18 references.
Ha (10)

Control of Grain Size in Open-hearth Carbon Steels (Le Contrôle de la grosseur du Grain des Aciers Martin au Carbone. *La Technique Moderne,* Vol. 26, May 15, pages 359-366; June 1, 1936, pages 402-406. Author summarizes knowledge on the subject with particular reference to work of S. Epstein and J. H. Nead.
FR (10)

Variants Influencing the Austenitic Grain Size as Determined by Standard Methods. R. SCHEMPP & C. L. SHAPIRO. *Steel,* Vol. 98, May 11, 1936, pages 66, 68. Abstract of paper before interchapter meeting of American Society for Metals at Pennsylvania State College, May 1-2. Results of studies carried out on straight C tool steels show that factors such as prior structural conditions and hot or cold mechanical deformation influence grain growth materially, thereby affecting results and interpretations of austenite grain-size rating as obtained by the usual methods and especially by the McQuaid-Ehn test. Grain growth is a function of time, temperature, and particle size.
MS (10)

Nature of Ferrite Banding in Rolled and Forged Steels. A. V. PROHOROFF. *Metallurg,* Vol. 11, June 1936, pages 35-42. In Russian. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 458L/10.
(10)

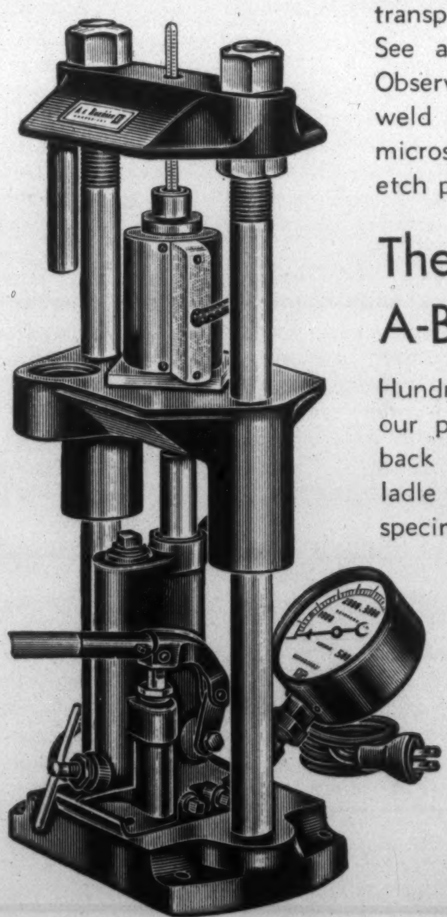
Preparation and Microscopic Examination of Metallic Specimens. G. W. PIRK. *Wire & Wire Products,* Vol. 11, Aug. 1936, pages 378-382; Sept. 1936, pages 430-435, 462. Methods and apparatus for determining physical and mechanical properties are described at length. Etching methods and etching solutions are described. Electrolytic etching is particularly suited to the etching of W, Cu-Ni and Cu-Sn alloys and Monel metal. Etching solutions for Fe and steel, Cu and its alloys, and printing processes are given in tables.
Ha (10)

Metallographic Applications of Electronic Rays and Their Physical Basis. II. Interference of Electronic Rays (Le applicazioni metallografiche dei raggi electtronici e le loro basi fisiche. II. Interferenze dei raggi electtronici). R. PIONTELLI. *La Metallurgia Italiana,* Vol. 28, July 1936, pages 301-315. A continuation. Electronic rays are diffracted in a manner similar to X-rays, and can be similarly utilized for determining crystal structure. Applications are described.
AWC (10)

Study of the Iron-Carbon System (Etude du Système Fer-Carbone) PENNANEACH. *Arts-et-Métiers,* Vol. 89, Apr. 1936, pages 75-81. Elementary.
FR (10)

The Thermal Expansion of Beryllium. E. A. OWEN & T. L. RICHARDS. *London, Edinburgh & Dublin Philosophical Magazine & Journal of Science,* Vol. 22, Aug. 1936, pages 304-311. Tests were made with 99.8% Be, along and perpendicular to the hexagonal axis, from 20° to 550° C. The structure of Be remained close-packed hexagonal over the temperature range, the parameters being $a = 2.2812_4$ A.U. ± 0.0003 and $c = 1.5682_1$ A.U. ± 0.0003.
Ha (10)

The Thermal Expansion of the Crystal Lattices of Cadmium, Osmium and Ruthenium. E. A. OWEN & E. W. ROBERTS. *London, Edinburgh & Dublin Philosophical Magazine & Journal of Science,* Vol. 22, Aug. 1936, pages 290-304. The expansion of Cd, Os and Ru along and at right angles to the hexagonal axis was determined by X-ray method between —220° and + 550° C.
Ha (10)



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11. PROPERTIES OF METALS AND ALLOYS

11a. Non-Ferrous

A. J. PHILLIPS, SECTION EDITOR

Photoelectric Properties of Pure and Gas-Contaminated Magnesium. R. J. CASHMAN & W. S. HUXFORD. *Physical Review*, Vol. 48, Nov. 1935, pages 734-741. The present study is a continuation of an earlier investigation by the authors on the effects of gases on the photoelectric sensitivity of Mg. A method for purifying Mg by multiple distillations is described. The threshold characteristic of all gas-free surfaces obtained by successive distillations is found to lie at 3430 ± 20 A. U. The threshold value at 5100 A. U., previously ascribed to pure Mg, is now definitely attributed to Mg contaminated by H. The effects of O are further investigated in detail, a very slight dosing giving rise to a maximum excursion of the long wave limit to about 5700 A. U. Calculations show that the formation of polar molecules on the Mg surface will account for the threshold shift observed when H or O is present. WAT (11a)

Some Metallurgical Properties of Copper-Nickel (70-30) Condenser Tubes. JOSEPH A. DUMA. *Journal American Society of Naval Engineers*, Vol. 48, Aug. 1936, pages 397-410. Condenser tubes which split at ends while being belled into tube sheets initiated the investigation. Tests were made as to chemical composition, cold workability, mechanical and physical properties, corrosion, micro-examination, effect of heat treatment. Results of drift pin expansion, rolling and belling, flattening tests for cold workability are given in tables, shown in macros and discussed in text. Hardness tests were made 90° apart with Vickers machine and defective tubes were shown to have unusually wide hardness range indicating either physical, chemical or structural heterogeneity. 70% Ni is considered ideal for high strength with good ductility. Cold formability of alloys containing more than 80% Cu is less than alloys containing 65-75% Cu in spite of lower hardness and better ductility of former. Corrosion test results are reported for mercurous nitrate, cold and boiling sea water. Photomicrographs are shown of material cold worked and annealed. Cold workability macros are shown after various annealing treatments. Age hardening is considerable in one alloy water quenched from 1650° F. and aged at various temperatures. WB (11a)

Beryllium and Its Alloys. A Correlated Abstract. JACK DELMONTE. *Metals & Alloys*, Vol. 7, July 1936, pages 175-180; Aug. 1936, pages 211-215; Sept. 1936, pages 239-242. Describes occurrence, ore concentration and smelting methods in the production of Be. Its chief characteristics are low sp. gr. 1.84, high strength and modulus of elasticity, marked hardening and embrittling effect of small amounts of impurities and its high cost. Chief use is in Cu alloys with up to 2% Be. The properties of these age-hardening alloys are discussed. WLC (11a)

The Electrical Resistivity of Bismuth Single Crystals. ALFRED B. FOCKE & JOHN R. HILL. *Physical Review*, Vol. 50, July 1936, pages 179-184. Measurements were made in the temperature range from —185° to 100° C. on Bi crystals containing Pb, Sn, Sb, and Te. The effects were found to be complicated but the following generalizations may be made. Decreasing temperature results in greater effectiveness of the impurity present except when the impurity concentration is such that a separation of phases occurs at low temperatures. Extremely small amounts (less than 0.03%) of all impurities cause a sharp increase in the resistance. The effect of larger amounts depends on the nature of the impurity. Pb and Sn continue to increase the resistance, additional Te forces the resistance to fall to lower values than that of pure Bi, additional Sb causes the initial rise of resistance to fall off and then to be slowly reestablished. More than 0.03% Sn and more than 0.3% Pb result in a negative temperature coefficient for the resistance parallel to the principal axis. In other cases the coefficient remains positive. The results may be explained on a combined theoretical and empirical basis. WAT (11a)

Bending Endurance of Duralumin at 350° C. (Die Wechselbiegefestigkeit von Duralumin bei 350° C.) G. EURINGER. *Metallwirtschaft*, Vol. 15, June 12, 1936, pages 540-541. Test pieces were cut from a 3 mm. duralumin sheet and temperature maintained by direct passage of an electric current. An endurance limit of 5 x 10^7 cycles was found at 350° (±20°, with a load of 2.7 kg./mm.^{2}) GD (11a)

Measurements on Bismuth. I. Heat and Electric Conductivity in Transverse Magnetic Fields (Untersuchungen an Wismutkristallen. I. Wärme- und Elektrizitätsleitung in transversalen Magnetfeldern) E. GRÜNEISEN & J. GIELESSEN. *Annalen der Physik*, Series 5, Vol. 26, July 1936, pages 449-464. The changes and relations of the two conductivities were determined at —183° and —195° C. and in transverse magnetic fields of 650-6100 oersted. In strong magnetic fields no definite simple relation of heat to electric conductivity could be established. 17 references. Ha (11a)

Principal Elasticity Constants of Single Crystals of Copper, Gold, and Lead (Hauptelastizitätskonstanten des Einkristalls Kupfer, Gold und Blei) E. GOENS. *Physikalische Zeitschrift*, Vol. 37, May 1, 1936, pages 321-326. Using a previously described dynamic method, the principal elasticity constants S_{ik} of Cu, Au, and Pb single crystals were determined. A considerable divergency from Kimura's results *(Science Reports Tohoku University*, Vol. 22, 1933, page 553) were found in the case of Cu. WH (11a)

The Conductivity of Super-purity Aluminium: The Influence of Small Metallic Additions. GASTON G. GAUTHIER. *Journal Institute of Metals*, Vol. 59, Aug. 1936, pages 375-392 (Advance Copy No. 743). The effects of common impurities on the conductivity of high-purity Al (99.99+%) were determined. A sample of very-pure Al had a conductivity of 65.45% that of Cu, the highest value ever reported. The elements added were Fe, Si, Cu, Zn, Ni, Mn, Mg, Ti, V and Cr. All elements lowered conductivity. Mathiessen's law was confirmed, but Norbury's law regarding the influence of various elements in lowering conductivity was not found to hold for Al as it does for Cu. It is possible to divide the elements into 3 groups with respect to their influence on conductivity: (1) Au, Ga, Ni, Si, Fe, and Zn, all of which have little effect; (2) Cu, Ag, and Mg, which have more effect; and (3) Ti, V, Mn, and Cr, all of which have considerable effect. 10 references. JLG (11a)

The Hall Effect and Some Other Physical Constants of Alloys. V. The Antimony-Silver Series. W. G. JOHN & E. J. EVANS. *London, Edinburgh & Dublin Philosophical Magazine & Journal of Science*, Vol. 22, Sept. 1936, pages 417-435. Resistivity, temperature coefficients of resistance, thermoelectric power, density and Hall effect were measured to determine their relation to structure of the Ag-Sb alloys. Alloys with more than 40% Sb by weight were brittle. No indication of a solid solution at the Sb end of the series was found, and also no change of phase at 72% Ag as was formerly assumed. Tests and results are given in detail. Ha (11a)

Silver-Indium Alloys. Notes on the Aging of Silver-Rich Ones. TRACY C. JARRETT. *Metals & Alloys*, Vol. 7, Sept. 1936, pages 229-231. Reports age hardening characteristics and microstructure of 1, 2 and 4% In-Ag alloys. WLC (11a)

The Creep of Tin and Tin Alloys. Part I. D. HANSON & E. J. SANDFORD. *Journal Institute of Metals*, Vol. 59, Apr. 1936, pages 181-202 (Advance Copy No. 733). Describes results of creep tests on Sn and some of its alloys in as-rolled condition. Ag up to 3.5% greatly improves creep resistance. Bi-Sn alloys are more resistant to flow than pure Sn at stresses above 300 lb./in.^{2}, but at lower stresses they are inferior to pure Sn. Sb improves creep properties of Sn. The alloy with 8.5% Sb withstood a stress 3 times that of pure Sn for an equal duration. Cd-Sn alloys are greatly improved by heat treatment and offer considerable resistance to creep. The mechanism of failure of these alloys is discussed. Results are given on tests of Pb-Sn solders and of the Cd-Sn eutectic alloy. These flow under stresses as low as 130-150 lb./in.^{2} It is shown that in many cases there is no relationship between creep and tensile strength. JLG (11a)

Copper Castings Alloyed with Be and Ti. Hardness and Conductivity after Heat Treatment. G. F. COMSTOCK. *Metals & Alloys*, Vol. 7, Oct. 1936, pages 257-260. Description of experiments on hardness and conductivity of Cu alloys containing one or more of the 3 elements, Be, Si and Ti. Co, Ni, Zn and Al were found to lower the conductivity to less than 23% that of pure Cu. Ti in Be-Cu alloys seems to stabilize the hardness at higher temperatures. WLC (11a)

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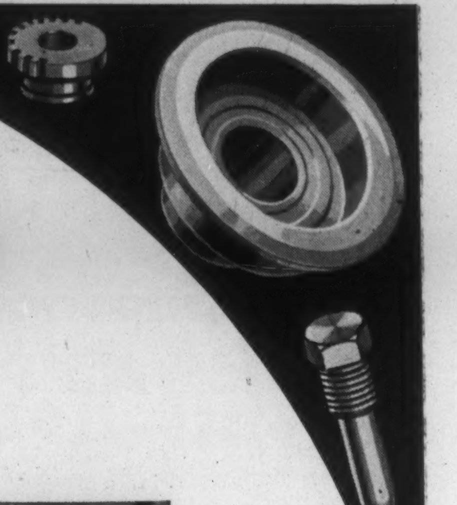

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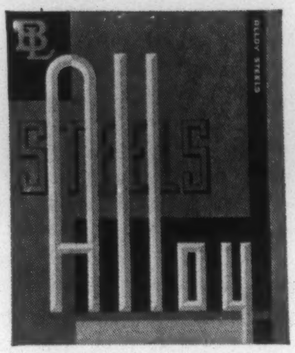

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Tests with Pure Aluminum Wire of Super Strength (Versuche mit Reinaluminium draht überhöhter Festigkeit) H. RÖHRIG & K. SCHÖNHERR. *Aluminium,* Vol. 18, Aug. 1936, pages 374-375. The occurrence of unusually high values of tensile strength (> 23 kg./mm.^{2}) in Al with very low Fe and Si content was observed and found to be due to undercooling of the billets or to too high rolling temperature. However, such high values reduce elongation and bending strength. Super-strength should be avoided. Ha (11a)

7

Magnesium Alloy Responding to Heat Treatment (Un alliage de magnésium à traitement thermique) ROCKAERT. *Revue de Métallurgie,* Vol. 33, July 1936, pages 427-430. A cast alloy containing: 8.5% Al, 0.5 Zn, 0.3 Mn, rest Mg, heated 24 hours at 420° C. and cooled in air has an elastic limit of 4.5-5 kg./mm.^{2}, tensile strength 24-27 kg./mm.^{2}, elongation 8-12%, reduction of area 8-15% and fatigue limit of 9-11 kg./mm.^{2} JDG (11a)

8

Mechanical Properties of Copper-tin Alloys (Sur les Propriètés mécaniques des Alliages Cuivre-étain) W. BRONIEWSKI & Z. WAWRZYNKIEWICZ. *Revue de Fonderie Moderne,* Vol. 30, May 10, 1936, pages 147-151. Contradictions in the description of mechanical properties of Cu-Sn bronzes are pointed out and results of new investigations described. The best mechanical properties for industrial purposes were encountered in the alloys with 12 and 22% Sn respectively. Ha (11a)

9

Effect of Silver on Lead. Deformation Markedly Reduced. J. NEILL GREENWOOD. *Chemical Engineering & Mining Review,* Vol. 28, Aug. 8, 1936, page 384. Small additions of Ag to Pb do not greatly affect the hardness but reduce the rate of deformation under stress. Results are shown of the influence of Ag additions in the proportions, 0.001%, 0.01%, 0.05% and 0.1%, on the creep rate of a Pb containing 0.0002 Cu, 0.004 Sb, 0.0023 Bi, 0.0007 Fe, 0.0003 Ag, 0.0005 Zn and 0.0002 Cd. The addition of 0.01% Ag to virgin Pb gives an appreciable increase in resistance to creep. This alloy should have valuable application in cable sheathing, water piping, etc. Hardness and tendency to creep do not parallel each other. The virgin Pb containing 0.01% added Ag is much more susceptible to intercrystalline cracking if annealed at 125° C. than if tested as rolled. WHB (11a)

10

6

The Tension Coefficients of Resistance of the Hexagonal Crystals Zinc and Cadmium. MILDRED ALLEN. *Physical Review,* Vol. 49, Feb. 1936, pages 248-253. The tension coefficients of resistance of the hexagonal crystals Zn and Cd have been measured. These coefficients have been found to be independent of the secondary orientation. This is in agreement with a theory set forth by P. W. Bridgman, as corrected by J. W. Cookson; furthermore the experimental points lie within experimental error of the curves given by the theory representing them as functions of the primary orientation. Cookson's correction gives the same formal dependence of the coefficients on the orientation as Bridgman's original theory, but demands additional constants fully to define the effect of deforming forces on the electrical resistance. Further experimental work will be necessary completely to determine this entire set of constants, and theory is sketched to show that torsion experiments would furnish the necessary data. WAT (11a)

The Viscosity of Sodium Amalgams. HENRY E. BENT & NORMAN B. KEEVIL. *Journal of Physical Chemistry,* Vol. 40, June 1936, pages 709-714. The viscosity of liquid Na and Ag amalgams is found to be independent of time. No scum forms on Na amalgams when kept in glass containers which have been properly baked and evacuated. These experiments indicate that Na amalgams are probably not colloidal. WH (11a)

Columbium, from a Laboratory Curiosity to a Widely Used Commercial Product. J. A. CRITCHETT. *Iron & Steel of Canada,* Vol. 19, Aug. 1936, pages 10-11. Brief history of discovery and development of technical uses. Ha (11a)

Experiments on the Electrical Resistance of Copper and Some Copper Alloy Wires. CLEMENT BLAZEY. *Journal Institute of Metals,* Vol. 58, 1936, pages 123-141, plus two plates. Includes discussion. See *Metals & Alloys,* Vol. 7, May 1936, page MA 257L/1. (11a)

The Physical Properties and Annealing Characteristics of Standard Nickel Silver Alloys. MAURICE COOK. *Journal Institute of Metals,* Vol. 58, 1936, pages 151-171. Includes discussion. See *Metals & Alloys,* Vol. 7, May 1936, page MA 258R/1. (11a)

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Aging Phenomena in a Silver-rich Copper Alloy. MORRIS COHEN. *Metals Technology,* Oct. 1936, *American Institute Mining & Metallurgical Engineers Technical Publication* No. 751, 20 pages. An alloy with 8.72% Cu was quenched from 765° C. after holding at temperature for 2 hr. It was then aged at 100°, 125°, 150°, 175°, and 200° C. for different times. Hardness, X-ray diffraction measurements, electric resistance, and dilatometric measurements were made. The results were interpreted as showing that knot formation plays an important part in the aging of Ag-Cu alloys. The linear relationship between the reciprocal of absolute aging temperature and the log. of the time required to obtain some definite point in the aging process was found to hold. For the alloy studied, 169° C. was the critical aging temperature below which the beginning of hardening (as measured by the Rockwell) occurs prior to precipitation, and above which the beginning of hardening occurs simultaneously with precipitation. The mode of precipitation is the same at all temperatures. Initial precipitation is gradual, but becomes more and more nonuniform as precipitation goes rapidly to completion in localized regions at the grain boundaries and twinning planes. These regions grow at the expense of the progressively precipitating areas until the precipitation process is complete. 19 references. JLG (11a)

The Magnesium-Copper Alloys. V. The Copper-rich Alloys. W. R. D. JONES. *Journal Institute of Metals,* Vol. 58, 1936, pages 143-150. See *Metals & Alloys,* Vol. 7, June 1936, page MA 314L/4. (11a)

Micro-plasticity in Crystals of Tin. BRUCE CHALMERS & E. N. DA C. ANDRADE. *Proceedings Royal Society,* Series A, Vol. 156, Aug. 17, 1936, pages 427-443; *Technical Publications International Tin Research & Development Council,* Series A, No. 44, 1936, 17 pages. The experiments are described on the isothermal stress-strain-time relations of single crystals of Sn of 2 grades of purity (99.98% and 99.996%), the stress being pure tension, and the strain being measured to 10^{-7} cm./cm. on a length of 3 cm. Creep occurred under all stresses, its initial rate being proportional to stress for small stresses, and of the order of 3×10^{-8} cm./cm./min. per g./mm.^{2} (micro-creep), while above a fairly definite stress of the order of 120 g./mm.^{2} the rate of creep increased much more rapidly with stress (macro-creep). Micro-creep decreases with time in a roughly exponential manner, and macro-creep remains constant for a long time. MAB (11a)

Tantalum as an Industrial Metal. *Engineering,* Vol. 141, June 19, 1936, page 680. Gives a brief history of Ta, method of recovery, properties and various uses. VSP (11a)

Commercially Important Wrought Copper Alloys. Chase Brass & Copper Company, Waterbury, Conn., 1936. Pamphlet, 8 x 10½ inches, 60 pages. The increasing tendency toward providing users of metallurgical products with really informative handbooks instead of mere catalogs, is well exemplified in this pamphlet. While the data are confined to products worked by Chase, as the title implies, it deals with the products made by most of the larger mills, almost the only exception being the "Olympic" Bronzes—Cu-Si-Zn alloys. Hence the data are generally applicable, no matter where the reader decides to order his stock from. For this reason the pamphlet will be kept close at hand for reference, not merely filed away in the catalog drawer. Besides data on strength, ductility, hardness and other readily measurable physical properties corresponding to the various alloy compositions at commercial ranges of tempers, the suitability of the alloys for hot and cold forming, for welding by different methods, and their approximate relative machinability compared to free-cutting brass, are stated. The degree of reduction involved in producing commercial "tempers" is tabulated, and, for alpha structures, the tempers in terms of grain size. The phraseology of commercial finishes is also explained. Weight and tolerance tables, and tables relating to gages are included. Uses to which the various alloys are put are indicated. The preparation of the pamphlet has obviously been in the hands of metallurgists rather than old-type salesmen. User metallurgists will appreciate the result.
HWG (11a)

British Non-Ferrous Metals Research Association—Sixteenth Annual Report. *Metal Industry,* London, Vol. 48, June 19, 1936, pages 689-693. In that portion of the report dealing with research it was stated that work has been started on a number of items selected from the long range program and that progress has been made on those now under way. 17 major researches were actively being studied at the end of the year. Brief reports were made on the following investigations: (1) properties of Pb, (2) metallurgical applications of the spectograph, (3) Al castings, (4) galvanized and Zn coatings, (5) condenser tube corrosion, (6) corrosion of Cu, (7) effect of cast structure on rolling properties, (8) removal of Bi from Cu, (9) electrodeposition, (10) the melting and casting of bronzes, and (11) Sb in soft solder. It was announced that a patent had been granted on the B.N.F. degassing process for the prevention of pin holes in cast Al-alloys. Minor investigations briefly referred to included (a) Pb and Pb-alloys, (b) Cu-Pb bearings and (c) soft solder.
HBG (11a)

Plastic Deformation and Age-Hardening of Duralumin. P. L. TEED. *Journal Institute of Metals,* Vol. 58, 1936, pages 113-122. Includes discussion. See *Metals & Alloys,* Vol. 7, Apr. 1936, page MA 202R/10. (11a)

11b. Ferrous

V. V. KENDALL, SECTION EDITOR

Molybdenum Permalloy Improves Loading Coils. *Bell Laboratories Record,* Vol. 14, Aug. 1936, page 386. An announcement that a small addition of Mo improves the magnetic properties of permalloy greatly, thus permitting a further decrease in size of telephone loading coils. RWD (11b)

Magnetic Stability of Ferromagnetic Fe Alloys (Uber die Magnetische Stabilität von Ferromagnetischen Eisen-Legierungen) W. S. MESSKIN & J. M. MARGOLIN. *Zeitschrift für Physik,* Vol. 101, July 20, 1936, pages 456-477. The magnetic stability of Fe alloys increases with increasing solid solution and an increasing homogeneous structure. With low field strengths, the constant for permeability increases with precipitation hardening. FHC (11b)

Design Factors Using Moderately Alloyed Steels. C. E. MACQUIGG. *Product Engineering,* Vol. 7, Oct. 1936, pages 387-389. Composition and properties of a number of typical moderately alloyed steels (with 0.1-0.4% C) are tabulated and points for using them advantageously in fabricated structures explained. In particular, when selecting a steel, it should be kept in mind that the higher tensile steel must still have sufficient ductility to meet the design requirements for ductility, shock resistance and notched bar impact values. Ha (11b)

Use of Cast Iron in the Chemical Industry. H. L. MAXWELL. *Foundry Trade Journal,* Vol. 55, July 9, 1936, pages 25-27. Paper read before the Chemical Engineering Congress of the World Power conference. Commercial gray cast Fe (T.C., 2.60 to 3.70; Si, 0.75 to 2.80; Mn, 0.60 to 0.90; S, 0.04 to 0.10, and P, 0.60% max.),low-alloy cast Fe, high duty, high-silicon and austenitic cast irons, resistance to caustic attack, etc. are discussed. AIK (11b)

Anomalous Magnetic Viscosity (Sur la viscosité magnétique anomale) A. Mitkevitch. *Journal de physique et le radium,* Vol. 7, Mar. 1936, pages 133-137. The variation in magnetic properties of materials with time (magnetic viscosity) and particularly the change in magnetic induction with time was investigated, using Fe filings, .1 mm. in diameter, suitably insulated in a liquid medium. FPP (11b)

Quality Tool Steel is Tested for Hardenability. Reinhold Schempp. *Metal Progress,* Vol. 30, Aug. 1936, pages 68-70, 72. Describes use of hardenability tests for control of tool steel quality. Details of tests are given and classification made into which steels fall according to their response. The effect of previous structure on the rate of transformation to austenite shown in the tests described checks with previous investigators. WLC (11b)

Sheet Metal Appraised by Hardness, Ductility and Grain-Size. Ernest E. Thum. *Metal Progress,* Vol. 30, Sept. 1936, pages 46-48, 92. Discusses use of chemical composition, heat treatment, grain-size, hardness, tensile strength and elongation in evaluation of utility of deep drawing steels. WLC (11b)

Wrought Iron. James Aston. *American Petroleum Institute, Drilling & Production Practice,* 1935, pages 226-238. Review of the history and characteristics of wrought Fe with a description of modern mechanical puddling. VVK (11b)

Fundamental Characteristics of Alloy Steel. E. S. Davenport. *American Petroleum Institute, Drilling & Production Practice,* 1935, pages 209-225. The why of the addition of alloying elements to steel and the purposes accomplished by the individual alloying elements is followed by a classification of alloy steels and definitions of heat-treating and metallographic terms. 15 references. VVK (11b)

Study of Tool Steel by Statistical Methods. V. A. Erakhtin & A. V. Ostapenko. *Kachestvennaia Stal,* Vol. 4, No. 6, 1936, pages 34-40. In Russian. Total production of a tool steel plant manufacturing 20 types of C and alloy steels was analyzed for different properties by the use of frequency curves. (11b)

The Influence of Wall-Thickness on the Mechanical Properties of Cast Iron. H Jungbluth. *Foundry Trade Journal,* Vol. 55, July 9, 1936, pages 21-23; July 16, 1936, pages 45-47. German exchange paper presented at the Annual conference of the institute of British Foundrymen. This paper is based on the statement of F. B. Coyle that the diminution in tensile strength of test bars of different thicknesses is represented by a straight line. The relationship between the diameter of the test bar and its strength can therefore be expressed as $y = Cx^m$ where C is a constant, x the diameter of the test bar and m is an exponent. From his curves Coyle deduced that $m = -\frac{1}{2.02}$. Jungbluth and Heller established that in the diminution in strength of a test bar the exponent m, representing the gradient of the curve, not the constant C that is the strength of the 1 in. bar, is the criterion determining the sectional sensitivity. In his summary the author states that for the plain cast Fe test bars, numerical relationship between C + Si and the sectional exponents are as close as can be expected only in the case of statistical relationship. The data on the sectional sensitivity of castings are very meagre. The sectional sensitivity of cast Fe is not peculiar to this material alone. It shares it with other cast alloys, cast Fe being thus comparable to Al, while black-heart malleable Fe has a lower, and cast steel no, sectional sensitivity. AIK (11b)

Honda-Ôkubo Theory Concerning the Magnetic Heating Effect Applied to Ferromagnetism (Der Magnetokalorische Effekt nach der Honda-Ôkuboschen Theorie des Ferromagnetismus) Kotaro Honda & Tokutaro Hirone. *Zeitschrift für Physik,* Vol. 102, Aug. 18, 1936, pages 132-137. Mathematical analysis shows that the above theory can be applied to ferromagnetism. FHC (11b)

Hardening Characteristics and other Properties of Commercial One Per Cent Carbon Tool Steels. T. G. Digges & Louis Jordan. *Bureau of Standards Journal of Research,* Vol. 15, Oct. 1935, pages 385-407; *Industrial Heating,* Vol. 3, Sept. 1936, pages 574-577, 606. See *Metals & Alloys,* Vol. 7, May 1936, page MA 259R/1. WAT + Ha (11b)

Choosing a Composition for Low-alloy High-strength Steel. S. Epstein, J. H. Nead & J. W. Halley. *Transactions American Institute of Mining & Metallurgical Engineers,* Vol. 120, *Iron & Steel Division,* 1936, pages 309-345. Includes discussion. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 466L/3. (11b)

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High Permeability and Plastic Flow in Magnetic Fields. J. F. Dillinger. *Bell Laboratories Record,* Vol. 14, Apr. 1936, pages 265-269. The relation of magnetic property of magnetic metals and alloys to the method of cooling in a magnetic field are explained. The lowest temperature at which the heat treatment required for the respective material is effective can be identified with that at which plastic flow begins to occur as the result of forces of magnetostriction. Ha (11b)

Large Alloy-Steel Forgings. T. M. Service. *Engineering,* Vol. 141, May 1, 1936, pages 489-492. Considers the progress made in the use of alloy steel forgings and discusses their defects such as corner ghosts, hair-line cracks, non-metallic inclusions, temper brittleness, and their prevention. Also gives data on mechanical tests conducted on large steel forgings. Includes tables giving the chemical and mechanical properties. VSP (11b)

Study of Some Steels Alloyed with Chromium, Silicon, Manganese, Molybdenum and Copper. S. G. Bogdanov. *Metallurg,* Vol. 11, Aug. 1936, pages 77-87. In Russian. Physical properties of steels containing 0.31% C, 0.40 Mn, 0.23 Si, 0.007 P, 2.34 Cr, 0.36 Mo; 0.34 C, 0.45 Mn, 0.23 Si, 0.014 P, 2.21 Cr, 0.15 Mo; 0.32 C, 0.42 Mn, 0.29 Si, 0.008 P, 2.24 Cr, 0.47 Mo, 1.86 Cu; 0.38 C, 1.53 Mn, 1.44 Si, 0.020 P, 0.37 Mo; 0.40 C, 1.47 Mn, 1.58 Si, 0.022 P, 0.16 Cr were investigated in the light of quenching temperature, drawing treatment and at low and high temperatures. Best properties at temperatures down to —60° C. wre obtained with 2.34% Cr, 0.36% Mo steel, the worst with 1.53% Mn, 1.44 Si, 0.37 Mo. (11b)

Properties of Some Cast High Alloy Heat Resistant Steels. P. P. Chichkanov & N. P. Nagornov. *Kachestvennaia Stal,* Vol. 4, No. 7, 1936, pages 31-37. In Russian. Heat resistance determination was done by heating for 60 hours in air or air containing 6-8% SO_2. Steels containing 1.56% C, 0.55 Si, 0.92 Mn, 29.26 Cr and 0.38 C, 1.76 Si, 0.70 Mn, 27.63 Cr, 2.04 Ni are stable up to 1000° C. though in SO_2 atmosphere the first is somewhat better. Their physical and heat resistant properties at high temperatures are inferior to steels with 0.60 C, 1.47 Si, 0.45 Mn, 23.84 Cr, 19.25 Ni and 0.59 C, 2.73 Si, 0.60 Mn, 20.32 Cr, 8.96 Ni, 1.06 Al. Alloy with 1.84% C, 1.75 Si, 1.90 Mn, 24.0 Al is fully resistant to furnace gases up to 1200° C.; an alloy with 0.46% C, 0.70 Si, 11.40 Mn, 2.11 Cr, 3.30 Al is resistant up to 1100° C. and can withstand shocks when heated even better than Cr-Ni steels. At lower temperature the last 2 metals are weak and brittle and are difficult to machine. (11b)

12. EFFECT OF TEMPERATURE ON METALS AND ALLOYS

The abstracts in this section are prepared in co-operation with the Joint High Temperature Committee of the A.S.M.E. and the A.S.T.M. The purpose of this cooperation is to make readily available complete references to the literature of this subject. The Committee does not necessarily subscribe to the statements of either the author or the abstractor.

The Effect of Molten Solder on some Stressed Materials. G. Wesley Austin. *Journal Institute of Metals,* Vol. 58, 1936, pages 173-192, plus 4 plates. Includes discussion. See *Metals & Alloys,* Vol. 7, Jan. 1936, page MA 33R/4. (12)

Embrittlement of High-tensile Alloy Steels at Elevated Temperatures. W. E. Goodrich. *Iron & Coal Trades Review,* Vol. 132, May 8, 1936, pages 840-844. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 468R/3. Ha (12)

The Creep of Metals. II. A. Nadai & E. A. Davis. *Journal of Applid Mechanics,* Vol. 3, Mar. 1936, pages A7-A14. Supplementing previous work (*Transactions A.S.M.E.,* Vol. 55, 1933, page APM 61) the effect of strain hardening on creep of metals is taken in consideration when determining the behavior of metals under varying conditions. Examples with Cu are described. Ha (12)

A Method of Analyzing Creep Data. R. G. Sturm, C. Dumont & F. M. Howell. *Journal of Applied Mechanics,* Vol. 3, June 1936, pages A62-A66. Existence of linear relationship between logarithm of creep and logarithm of elapsed time for a given material at ordinary temperature and constant stress was definitely established, and it was further found that when homologous stresses based on tensile strength of the material are considered, different materials exhibit very similar characteristics between homologous stress and logarithm of time to produce a certain amount of creep. 10 references. Ha (12)

The Embrittlement of High-tensile Alloy Steels at Elevated Temperatures. W. E. Goodrich. *Engineering,* Vol. 141, June 12, 1936, pages 651-653. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 468R/3. VSP (12)

Thermal Expansion of Solid Materials at Low Temperatures (Cu, Ni, Fe, Zincblende, LiF, Calcite, Aragonite, NH_4Cl) (Studien zur thermischen Ausdehnung fester stoffe in tiefer Temperatur, Cu, Ni, Fe, Zinkblende, LiF, Kalkspat, Aragonit, NH_4Cl) H. Adenstedt. *Annalen der Physik,* Series 5, Vol. 26, May 1936, pages 69-96. A new apparatus is described to measure thermal expansion by the interference method between 0° and —195° C. The experiments confirm for Ni, Cu and Fe the theory that the cubic thermal expansion coefficient increases at low temperatures in proportion to the specific heat c_v while zincblende, LiF, calcite and aragonite show some deviations. 46 references. Ha (12)

Tensile Properties of Steels at Temperatures Below and Above Normal. D. A. R. Clark. *Engineering,* Vol. 142, July 24, 1936, pages 104-105. Describes investigation on the tensile properties at temperatures between —185° C. and +200° C. on thin-walled tubing of two 0.40 C steels with 0.45 and 0.6 Mn. Tubes used were seamless 1¼" in diam. and No. 20 gage. They were annealed at a temperature of 850° C. Results of tests show that there is no danger at low or moderately low temperatures as used in refrigerating plants. If however, parts are subjected to shock care should be exercised in choice of material. VSP (12)

MANY SIZES

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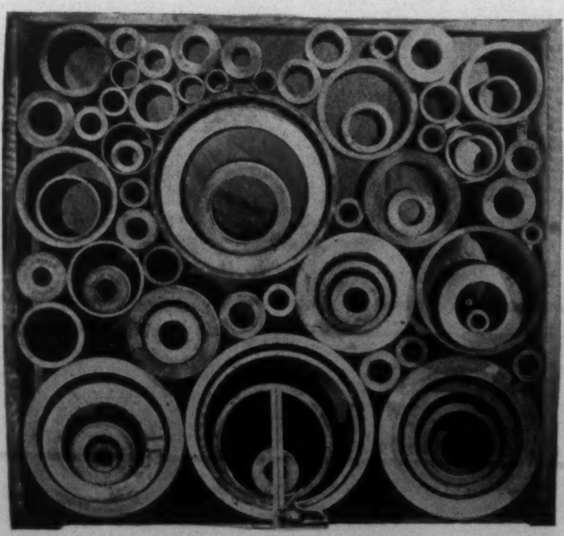
MANY WALL THICKNESSES



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Brittleness of Steel at Sub-Zero Temperatures and Rapid Cooling Brittleness of Annealed Steel. SABURO WATANABE & KIYOSHI NAGASAWA. *Tetsu to Hagane,* Vol. 21, Nov. 25, 1935, pages 880-887. In Japanese. Part I. The brittleness of steels at sub-zero temperatures: Charpy impact test was carried out at low temperature on 6 kinds of plain C-steel (0.04-0.98% C) which were annealed, quenched in water, or quenched and tempered at various temperatures. The test pieces were cooled to various temperatures between +25 and —60° by means of ether and dry ice. The impact values of the annealed specimens of C-steel suddenly drop between + 25 and —20°, and those of the quenched specimens between +25 and —40°. Quenched low C-steel shows less brittleness than the annealed, and the impact values of the former increase by tempering at low temperature. Quenched and tempered specimens showed the least brittleness at sub-zero temperature among the specimens in 3 heat-treated states. From the impact test at sub-zero temperatures of the quenched and tempered (400°-650°) specimens of Ni-Cr, Ni-Cr-Mo, Cr-Mo, low C-Ni-Cr steels, it was found that steels containing Ni show less brittleness than those without Ni. The brittleness of steels at sub-zero temperatures is not characteristic of α-iron itself, but is due to the presence of carbides, for instance Fe_3C and carbides of Cr, Mo, etc., and to internal stress introduced at the boundary surface of α-iron and foreign substances. Part II. Rapid cooling brittleness of annealed steel: By impact tests on 6 kinds of carbon steels (0.10-0.36% C) which were annealed at 920°-850°, reheated at 500°-700° for 1 hr. and then quenched in water, an extreme brittleness was found at room temperature. This phenomenon can be seen in the steel which was rapidly cooled from the temperature close to and under the critical point, and was named "Rapid cooling brittleness of annealed steel" by the authors. This brittleness is attributed to the precipitation hardening of Fe_3C at room temperature and reaches a maximum when a week or more elapses after the rapid cooling. TS (12)

Embrittlement of Steel on Prolonged Heating. H. A. DICKIE. *Engineering,* Vol. 141, Mar. 13, 1936, pages 301-302. The brittleness developed during prolonged heating of steels below the lower critical temperatures is caused by the deposition of carbides at the grain boundaries. This explanation has not received unanimous acceptance because the existence of carbide film at grain boundaries has not been demonstrated visually. VSP (12)

Strength of Steel at High Temperatures (Procédés de résistance des aciers aux températures élevées) M. ROS & A. EICHINGER. *Revue de Métallurgie,* Vol. 33, Apr. 1936, pages 217-220. General considerations and theories. JDG (12)

On the Optical and Electrical Properties of Thin Metallic Films at Low Temperatures. First and Second Reports. TADAO FUKUROI. *Bulletin Institute of Physical & Chemical Research Tokyo,* Vol. 15, July 1936, pages 411-429; Aug. 1936, pages 663-673 (In Japanese); *Scientific Papers & Abstracts Institute of Physical & Chemical Research, Tokyo,* Vol. 29, July 1936, page 27; Aug. 1936, page 35 (In English). The spectral reflectivity of light and the electrical conductivity at liquid air temperature of Hg, Cd, and Zn films condensed from vapors have been investigated. The results of the spectral reflectivity of light is compared with the theoretically predicted one. The theoretical considerations assume that the film (Hg) consists of colloidal particles of a spherical form. The decrease of electrical resistance due to the exposure of ultra-violet rays, i.e. the photo-conductivity, of the condensed films of Hg, Cd, and Zn was studied at low temperatures. The experimental results are explained on the assumption that the above effect is brought forth by the ordinary photo-electric effect of colloidal particles of metals deposited as a thin film on the surface of quartz or glass. WH (12)

Mechanical Properties of Aluminium and Its Alloys after Prolonged Heating. A. VON ZEERLEDER & R. IRMANN. *Journal Institute of Metals,* Vol. 59, July 1936, pages 335-358 (Advance Copy No. 740). Strength of Al and several Al alloys was determined after heating for long periods at 75° to 300° C. Strength of some materials at elevated temperature was also determined after complete stabilization. Heating periods extended up to 2 years. After holding at elevated temperatures some specimens were cooled to room temperature and then tested and others were tested at the elevated temperature. For complete softening at 250° C. heating periods of at least 6 months are required for pure Al and Anticorodal, and of more than 2 years for Avional and "Y" alloy. A still longer time is necessary to completely soften alloy "R.R. 59." To determine decrease in strength of any material after heating for long periods at elevated temperature it is necessary to carry out tests of long duration. The values of yield point observed in the normal short-time test after heating periods of 1 year form a basis for calculation for engineers. The permissible loads can be ascertained only by observation of the creep limit. This is being studied by the author. JLG (12)

13. CORROSION AND WEAR

V. V. KENDALL, SECTION EDITOR

Effect of Corrosion on Coated and Uncoated Pipe Lines. *Petroleum Engineer,* Vol. 7, June 1936, page 51. 3 pipe-line companies in 1917 each laid an 8" threaded line in northern Texas and southern Oklahoma. Company No. 2 and Company No. 3 coated their lines with asphalt and wrapped them with saturated felt. Company No. 1 did not protect its line in any way. The lines were taken up in 1935. Part could be spot-welded or reconditioned in some way, part was still usable without spot-welding, part had to be rejected after it was taken up or to be abandoned in place, and part was usable but not good enough to ship for laying in a new line. Co. No. 1 found 46.12% of its line suitable for using again directly, No. 2 and No. 3, 87.7% of their jointly laid line, No. 2, 86.52% of its exclusive line, No. 3, 96.62%. No. 1 could spot-weld 18% of its line, No. 2 and No. 3 5.85% of its separate line. Co. No. 1 found nearly 25% of its line usable but not fit for shipping and re-laying and over 8% of its line was entirely a loss. Co. No. 2 and Co. No. 3 lost 3.75%, Co. No. 2 alone 4.20%, No. 3 only 0.36%. Neither No. 2 nor No. 3 had any pipe that could not be shipped and relaid. Co. No. 1 could salvage 64% of its pipe, and the other two (affiliated), 93.5%. GTM (13)

The Influence of Light on Electrode Potential and Corrosion Phenomena of Certain Non-ferrous Metals. C. O. BANNISTER & R. RIGBY. *Journal Institute of Metals,* Vol. 58, 1936, pages 227-253. Includes discussion. See *Metals & Alloys,* Vol. 7, June 1936, page MA 316R/6. (13)

Passivity of Iron and Steel in Nitric Acid Solution...Report IX. YOICHI YAMAMOTO. *Bulletin Institute of Physical & Chemical Research, Tokyo,* Vol. 15, June 1936, pages 350-383, in Japanese; *Scientific Papers & Abstracts Institute of Physical & Chemical Research, Tokyo,* Vol. 29, June 1936, pages 25-26. In English. Pursuing previous research (See also *Metals & Alloys,* Vol. 4, page MA 281 L/10; Vol. 5, page MA 462 R/2; Vol. 6, pages MA 75L/8, MA 123R/4, Ma 167L/9, MA 417R/1, MA 417R/2; Vol. 7, page MA 150R/2) the potential difference between the active Fe in dilute HNO_3 solution and the passive Fe in concentrated HNO_3 was measured and found to be 0.33 — 0.39 volts. This potential difference may correspond to the difference between the electrode potential of the Fe in the ferrous and ferric conditions

$$Fe/Fe'' = -0.43 \text{ volts}$$
$$Fe/Fe''' = -0.04 \text{ volts}$$

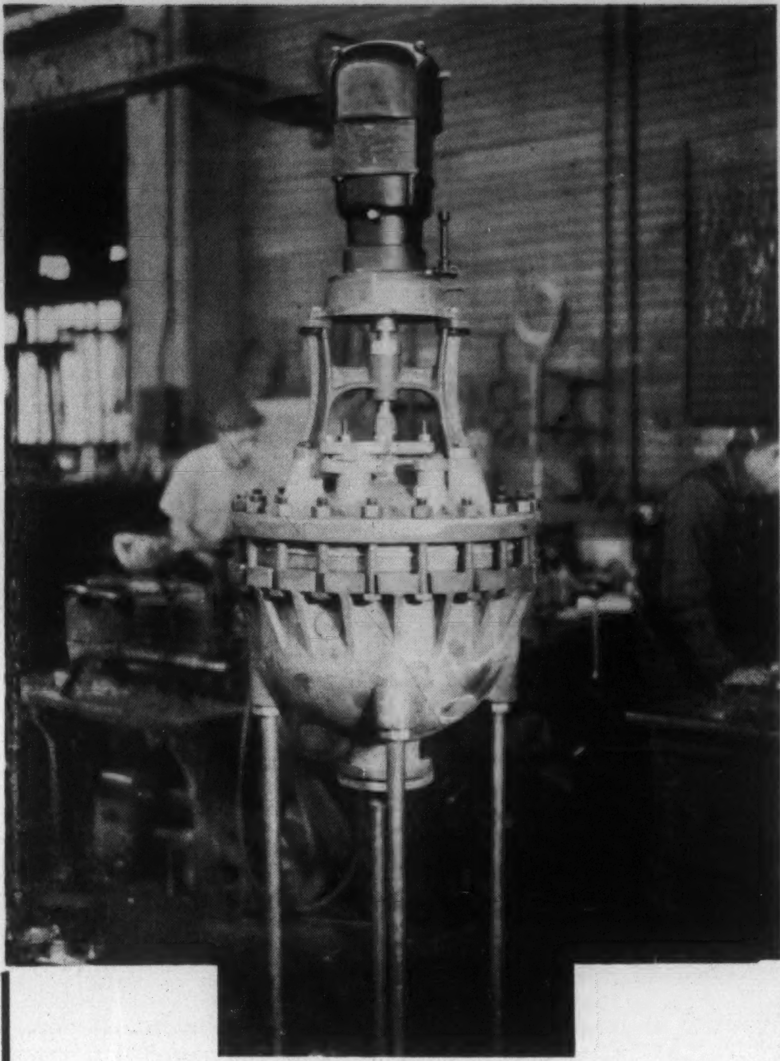
Furthermore the potential change of Fe coupled with Pt was observed in HNO_3. When the Fe becomes passive, the potential difference between Fe and Pt is lowered, and the difference between the maximum (the potential difference between the active Fe and Pt) and the minimum (the potential difference between the passive Fe) is about 0.75-0.78 volts, which value corresponds to the standard potential for

$$Fe''' + e \rightarrow Fe'' + 0.748 \text{ volts}$$

It is deduced that the surface of the passive Fe is in the ferric condition and the active Fe is in the ferrous condition. WH (13)

Some Recent Developments in Operation and Maintenance of Surface Condensers. A. H. MOODY. *Combustion,* Vol. 8, Aug. 1936, pages 19-22. Increased resistances to corrosion and inlet-end erosion of steam condenser tubes made of Al bronze alloy containing 95% Cu and 5% Al, and Al brass containing 75% Cu, 22.5% Zn and 2.5% Al are shown, compared with admiralty metal. Al bronze tubes were used for 23 years where admiralty tubes showed a life of a few years; Al brass had a life of over 5 times that of admiralty metal. ERK (13)

Destruction of Metallic Materials by Water-hammer (Zerstörung metallischer Werkstoffe durch Wasserschlag) M. v. SCHWARZ & W. MANTEL. *Zeitschrift Verein deutscher Ingenieure,* Vol. 80, July 11, 1936, pages 863-867. The resistance of various metals to cavitation was investigated with a drop-impact instrument as first described by de Haller and E. Honegger. The test results proved that, to produce cavitation, pressure maxima of about 30,000 atm. but of short duration and small energy content must occur. Materials with low elastic deformability are shattered if they are not practically deformable, otherwise cold-strengthening takes place until the deformability is passed and fracture occurs at the surface. Pieces with high elastic deformability show destruction mostly at defective places of the structure. On the basis of the results Cu alloys which are very resistant against water-hammer have been produced. Ha (13)



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Determination of the Corrosion Behavior of Painted Iron and the Inhibitive Action of Paints. R. M. BURNS & H. E. HARING. *Bell System Technical Journal,* Vol. 15, Apr. 1936, pages 343-348. In a previous paper (see *Metals & Alloys,* Vol. 7, Oct. 1936, page MA 509R/3) one of the authors advocated the use of time-potential curves for indicating and predicting the corrosion behavior of a metal. If the potential of a metal becomes more electropositive with time, corrosion is ceasing or stopped; if the potential becomes negative, corrosion is being accelerated. This method was applied to Fe coated with 2 types of paints: (a) red oxide primer, a physical inhibitor and (b) red Pb primer, a chemical inhibitor of corrosion. As may be expected the red oxide primer protects or keeps Fe passive only as long as it is able to exclude moisture; corrosion then sets in. Added varnish increases the time of protection from a few minutes to some hours. Red Pb primer keeps Fe passive even when the protective coat appears to the eye to be imperfect. The convenience of this method of study suggests its use for the study of the protection afforded by organic coatings or the corrosion behavior of Fe buried in soil or encased in concrete. HFK (13)

Factors Influencing the Rate of Attack of Mild Steels by Typical Weak Acid Media. T. P. HOAR & D. HAVENHAND. *Iron & Coal Trades Review,* Vol. 132, May 29, 1936, pages 993-994; discussion, June 5, 1936, pages 1025-1026. See *Metals & Alloys,* Vol. 7, Sept. 1936, page MA 470R/4. Ha (13)

Bimetallic Corrosion Promoted by Copper-Aluminium Contacts. P. MABB. *Metallurgia,* Vol. 14, June 1936, pages 29-31. Cites results of laboratory experiments to prove that Cu-Al contacts promote corrosion by electrolysis and that Cu-Al alloys corrode rapidly because of difference in potential between Cu and Al. JLG (13)

Experimental Study on the Method of the Submerged Corrosion Test. YOICHI YAMAMOTO. *Bulletin Institute of Physical & Chemical Research, Tokyo,* Vol. 15, July 1936, pages 451-480. In Japanese. *Scientific Papers & Abstracts Institute of Physical and Chemical Research,* Tokyo, Vol. 29, July 1936, pages 29-30. In English. The effect of the testing condition on the amount of corrosion of the test piece immersed in the corrosive solution was observed. The amount of corrosion is reported as the average penetration corrected for volume change. This is the first installment of a series of papers, a full report of which is promised in English when the study is completed. WH (13)

History of the Phosphate Rust Protection (Geschichte des Phosphatrostschutzes) O. MACCHIA. *Korrosion & Metallschutz,* Vol. 12, Aug. 1936, pages 197-202. Gives a list of 62 references on the subject. See also *Industria Meccanica,* Vol. 18, 1936, pages 492-495. Ha (13)

Metallic Wear. H. W. BROWNSDON. *Journal Institute of Metals,* Vol. 58, 1936, pages 15-38. Includes discussion. See *Metals & Alloys,* Vol. 7, May 1936, page MA 263L/3. (13)

Study on the Phenomena of the Abnormal Corrosion in Condenser Tubes. KURAZO FUKAGAWA & KEN'ICHIRO KAMIYAMA. *Bulletin Institute of Physical & Chemical Research,* Tokyo, Vol 15, July 1936, pages 641-654. In Japanese. *Scientific Papers & Abstracts of the Institute of Physical & Chemical Research,* Tokyo, Vol. 29, July 1936, pages 32-33. In English. Among the 5 types of abnormal corrosion in condenser tubes previously described (see *Metals & Alloys* Vol. 7, Sept. 1936, page MA 469R/4) two types, i.e. horse-shoe-type corrosion figures and V-letter-type corrosion figures or pitting corrosion figures have been experimentally deduced and described as follows: (1) Diameter of the loop head of horse-shoe-type corrosion figure is about 4 mm. — 0.2 mm. (2) Diameter of the upper circle of V-letter-type corrosion figures is about 3 mm. — 1 mm. (3) The time required for inducing the above two corrosion types is about 19 — 11 days. The large extent of corrosion and the short time for producing both types are unique and have not been published in any paper heretofore. The development of the horse-shoe-type corrosion was easily accelerated by properly accentuating the chemical and hydrodynamical effect. WH (13)

Service Test with a High Pressure Boiler Provided with Inside Coatings (Betriebsversuch mit Innenanstrichmitteln an einem Hochdruckkessel) G. AMMER & H. H. MULLER-NEUGLUCK. *Die Wärme,* Vol. 59, July 25, 1936, pages 489-494. Reports on experiments with 6 different graphite, resin or Fe-oxide-bearing bituminous coatings applied to a high-pressure boiler. (28 atm., 231° C.) These non-metallic coatings yielded fairly good service, so that their utilization appears to be warranted under certain service conditions. Better results were obtained in ordinary fire-tube boilers than in high-pressure boilers. 15 illustrations show the appearance of the coatings before and after the experiments. WH (13)

14. APPLICATION OF METALS AND ALLOYS

14a. Non-Ferrous

G. L. CRAIG, SECTION EDITOR

Some New Uses of Cobalt (Quelques emplois nouveaux du cobalt) R. PERRAULT. *Génie Civil,* Vol. 108, Mar. 14, 1936, pages 254-257. Besides the well known uses for Co such as binder for sintered hard alloys, components of stellites and plating, Co is now employed as a catalyst for making fuel oils under atmospheric pressure and as a component part of many new magnetic alloys. JDG (14a)

A Preliminary Report of Tests Made to Determine the Physical Properties and Clinical Values of Gold and Platinum Foil. R. W. RULE. *Journal American Dental Association,* Vol. 23, Jan. 1936, pages 93-96. Pure Au foil is used for filling tooth cavities but is considered too soft for wear resistance in severe service. By placing a sheet of Pt between 2 Au sheets and then beating into foil, a composite material completely covered with Au is obtained which is said to work almost as easily as pure Au. This composite foil of Au and Pt produces a harder inlay, the relative Brinell hardness for Au and Au-Pt being about 48 and 54 as condensed in a cavity and 62 and 79 as cold rolled. Of 2 manufacturers of the composite Au-Pt foil, one makes a product which shows a maximum hardness of about 78 and the other about 99 Brinell. The color of the Au-Pt foil inlay is dull, lacking in luster and richness, and in general is less favorable than that of pure Au. Further research is in progress. OEH (14a)

Oligodynamic Action of Silver in Root-Canal Antisepsis: Preliminary Report. LYON P. STREAN. *Dental Cosmos,* Vol. 78, Mar. 1936, pages 241-245. Pure Ag wire was "flamed" over a Bunsen flame and its oligodynamic action in cultures studied. The surface area of soluble Ag salt is considered the determining factor as a criterion of disinfecting power. The author concludes that the preliminary tests are encouraging and that further experiments are being carried on *in vivo* and *in vitro.* 14 references. OEH (14a)

Aluminum Name Plates. H. K. WORK. *Metal Industry,* New York, Vol. 34, Sept. 1936, pages 327-329. Engraving, stamping, coining, embossing, casting, etching and Alumilite finishing are described. CBJ (14a)

14b. Ferrous

M. GENSAMER, SECTION EDITOR

Steel Metallurgy in Relation to Marine Engineering. W. H. HATFIELD. *Journal & Record of Transactions, Junior Institution of Engineers,* Vol. 46, July 1936, pages 419-448; *discussion,* pages 448-460; *appendix,* pages 460-464. Second Commemoration Lecture before the Institution at Sheffield, Mar. 1936, deals with specifications for marine forgings, statistical study of 46,478 screw-shafts broken in service, effect of varying heat treatments on medium C-steel, typical analyses and mechanical properties of various steels, mechanical tests of forgings, 15 typical microstructures of steel used in ship building. A wealth of information is collected in 11 tables and the appendix gives detailed information on the type of steel used for 55 various ship parts. WH (14b)

Technic of Orthodontic Appliance Construction Using Chrome Alloy Metals. WILLIAM R. HUMPHREY. *Journal American Dental Association,* Vol. 23, Aug. 1936, pages 1471-1480. The author uses 18% Cr-8% Ni steel stabilized by such elements as Ti. He attributes earlier failures to improper heating of the metal in welding. Spot or shot welding is preferred over soldering. By using stainless steel he reports that the size can be reduced to 1/3 to 1/2 the diameter of Au-Pt wire. Dentists are cautioned to become familiar with the literature relating to the handling of stainless steel. OEH (14b)

Meat Packers Use Stainless. CURTIS C. SNYDER. *Metal Progress,* Vol. 29, June 1936, pages 65-67. Properties of stainless make it desirable for equipment in meat packing and other food industries. It is resistant to corrosion by the processing and cleaning materials used, retains a bright surface, leaves no metallic taste or color in meat processed and reduces maintenance costs. WLC (14b)

Ferrous Metallurgy in Relation to Aircraft. W. H. HATFIELD. *Journal Royal Aeronautical Society,* Vol. 39, June 1935, pages 552-618. With discussion. A comprehensive and detailed discussion is presented of the use of steels in aircraft construction. The choice of material ~~for a particular part depends on (a)~~ strength to weight ratio, (b) reliability and (c) adaptability to required forming operations. True elastic limit must be greater than maximum service stress to avoid "permanent set." Data are given to show, however, that "proof stress" (0.1% of permanent set) and fatigue limits do not parallel each other in different types of steels. Advances since 1917 in C, low alloy, high tensile alloy, casehardening, nitriding, valve and high thermal expansion steels are briefly discussed. Developments in stainless steels are covered at great length, particularly welding properties, machining, galvanic corrosion, corrosion fatigue and aircraft applications. A large section, including 22 photomicrographs is devoted to the metallography of aero steels. The paper includes an appendix in which are tabulated (a) data on typical aircraft performance since 1905 (b) strength-weight ratios of several wrought ferrous and non-ferrous materials, (c) specification numbers, heat treatment, mechanical and physical properties of 31 ferrous materials used in aircraft construction, (d) a complete table of current air ministry steel specifications and (e) classifications of materials according to applications. FPP (14b)

New Valve Steel for High Compression Engine. *Automotive Industries,* Vol. 75, July 25, 1936, page 124. **Engine Performance Places New Demand on Valve Steels.** *Steel,* Vol. 98, June 1, 1936, page 44. A series of new valve steels for severe operating conditions known as Silchrome X (Ludlum Steel Co.) are described. Silchrome X-10 is an 18-8 austenitic steel with high strength, 17,500 lbs./in.^{2} at 1600° F., good resistance to corrosion, good work hardening properties and fair seat hardness at high temperatures. It has no critical temperature, hence little tendency to warp. Silchrome X-9 contains considerable Si and W making it even stronger. It resists indentation on the seat and is recommended for aircraft engine exhaust valves. Silchrome XB for passenger cars and light trucks is a ferritic hardenable steel which compares favorably with the best austenitic steels for corrosion resistance. Exact compositions not given. BWG + MS (14b)

Designing and Fabricating with Light Metals (Gestalten und Bauen in Leichtmetall) W. ZARGES. *Aluminium,* Vol. 18, Aug. 1936, pages 353-360. The properties of light metals and points to be observed in their use to make the best of their qualities with respect to strength, corrosion resistance and price, are discussed. Ha (14b)

The Failure of Galvanizing Baths. D. ROSS. *Sheet Metal Industries,* Vol. 10, Aug. 1936, pages 593-595. Pan is best made of mild steel. Bath temperature should be kept at 460° C. as a maximum. Firing methods are reviewed and the need to guard against over-heating is stressed. AWM (14b)

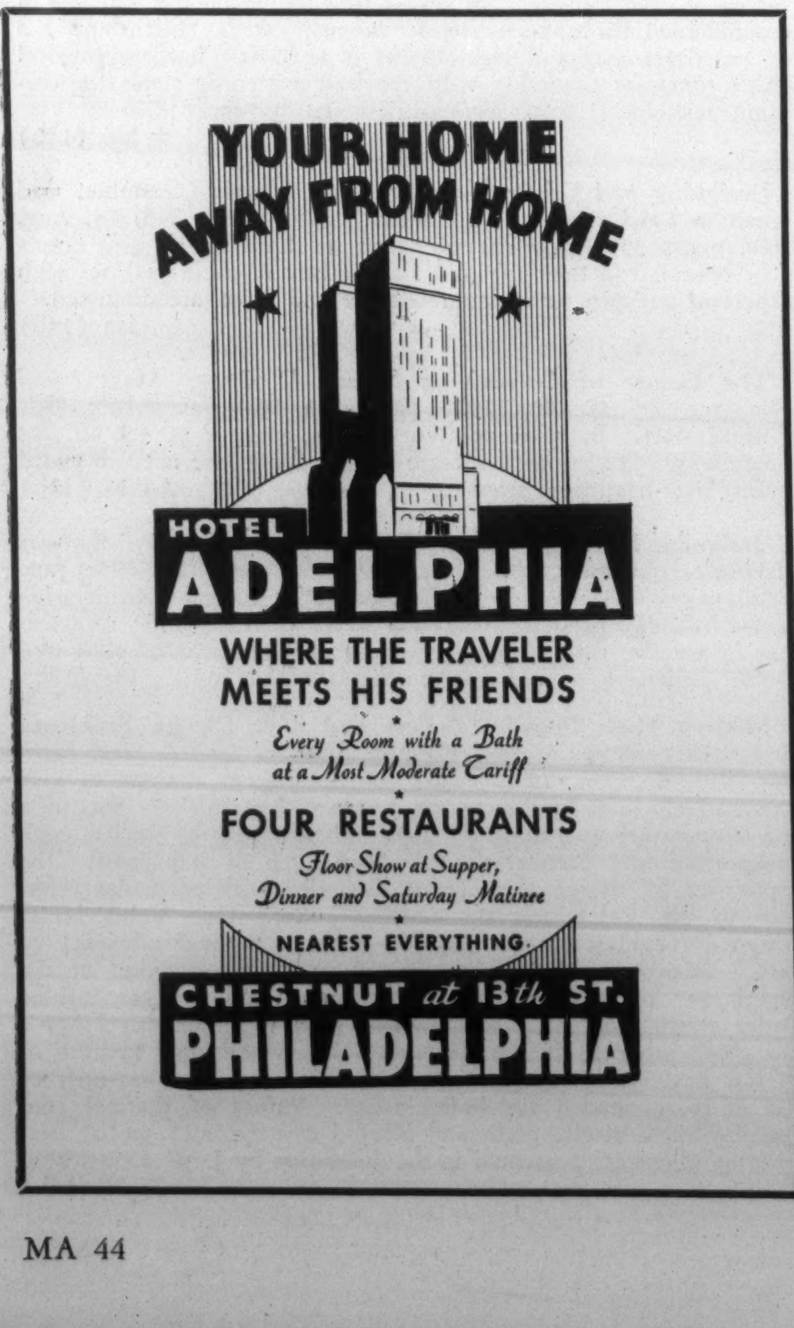
Designing for High Tensile Steels. H. M. PRIEST. *Railway Mechanical Engineer,* Vol. 110, May 1936, pages 179-183; June 1936, pages 243-248. Design methods for correct consideration of the valuable properties of alloy steels are explained; comparisons of weight, strength and deflection characteristics of alloy and C steel structures, and of cost are discussed. Ha (14b)

Modern High Pressure Boilers and their Design Problems. A. L. MELLANBY. *Journal West of Scotland Iron & Steel Institute,* Vol. 43, Jan. 1936, pages 59-70. Recent designs to give increased efficiency use increased pressure (up to 3200 lbs./in.^{2}) and temperature (up to 1000° F.). The strength of steel at high temperature and particularly the creep limit is important. The application of design formulas is discussed with particular reference to the Velox and the Loeffler boiler. One Velox boiler designed for blast furnace gas firing has a thermal efficiency of 92%. Standard materials were used with the exception of the superheater tubes which were of sicromal and the gas turbine blades which were of a Mo-W alloy steel. Stainless steel has a low creep rate, but is not economical for boiler tubes because of its low heat conductivity. C steel containing a small quantity of Mo is recommended for boiler tubes. Values of thermal conductivity of C steels, plain and alloyed cast Fe, and special heat resisting alloys are presented in the discussion by J. W. Donaldson. FGN (14b)

Remarks on the Mechanical Properties of Materials Used in the Construction of Agricultural Machinery (Considerzioni sulle Proprieta di Resistenza dei Materiali usati nelle Costruzioni meccanico-agrarie) A. CARENA. *Industria Meccanica,* Vol. 18, July 1936, pages 401-407. The fact is stressed that materials used in agricultural machinery, which at present are considered as of inferior importance to other structures and machines, should be selected and used in the same careful manner as for other applications. A few data of mechanical properties of steel and cast Fe are given, and suggestions made for correct calculation of stresses in agricultural machinery. Ha (14b)

Sectional Drill Steel—A Recent Development in Mining at Noranda Mines, Ltd. FRED S. DUNN. *Canadian Mining Journal,* Vol. 57, Aug. 1936, pages 372-375. Mining with sectional steel has proved very satisfactory. Methods are outlined. The couplings are made of mild case-hardened steel and are equipped with a strong round left-hand thread. The drill rods are made up in 2, 4, and 6 ft. lengths with the shanks and fillers made of Atlas special fatigue-resisting alloy steel. Well over 1,000,000 tons of ore have been drilled to date and where conditions are favorable long hole mining is cheaper than short hole methods. Factors involved: (1) the drilling is done on contact as one continuous operation, (2) the burden on the holes per foot drilled is a predetermined maximum. (3) power consumption is easily controlled. (4) the use of long holes diminishes the amount of development necessary and (5) the use of sectional steel helps to simplify the transportation difficulties as no long steel has to be handled. WHB (14b)

Strontium. E. G. ERICK & GORDON H. CHAMBERS. *Foote Prints,* Vol. 9, June 1936, pages 11-19. 2 ores, celestite and strontianite are used as source of Sr metal. Industrial uses reviewed for use of Sr in beet sugar industry, manufacture of NaOH where Sr removes SiO_2, Fe and Mn from concentrated solutions, pyrotechnics and medicine. Use of Sr metal as Sr-Mg alloy for radio tubes superseded by use of Ba alloy; for steel making strontianite ore has been used in Germany to produce basic, fluid slag with greater desulphurizing power, replacing fluorspar for fluxing. Sr carbonate is useful for welding rod coating and for increasing slag fluidity. For ceramic glazes, etc., $SrCO_3$ has no advantages over Ba and Ca. A number of other miscellaneous uses are cited. WB (14b)



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Colloidal Zinc. *Automotive Industries,* Vol. 75, Sept. 5, 1936, page 328. Lubriplate is a gear and chassis lubricant compounded with colloidal Zn. The protective, self-lubricating film provided by the colloidal Zn makes Lubriplate useful for chassis leaf spring lubrication. CMH (14b)

Laying 282 Miles of Rail in 66 Days. *Railway Engineering & Maintenance,* Vol. 32, Sept. 1936, pages 532-535, 547. A rail renewal program that involves, in total, 562 miles of new and released rail is described. FPP (14b)

Steel Concrete Building Construction. R. E. MCMILLAN. *Commonwealth Engineer,* Vol. 23, Mar. 2, 1936, pages 240-242. Substantial economies in the construction of steel framed buildings are made possible by the method patented by the author, in which vertical columns of the normal type are employed for the frame, but the horizontal girders are replaced by fabricated units made up of welded reinforcement ready to be incorporated into reinforced concrete beams. This method of frame construction results in the building incorporating the particular advantages of both steel frame and reinforced concrete T-beam construction. WH (14b)

Nickel-Iron Alloys. Their Application in Electrical Engineering. N. W. MCLACHLAN. *Electrician,* Vol. 117, Aug. 28, 1936, pages 249-252. The Ni-Fe alloys are divided into 2 groups: (a) those of very high permeability and (b) those of moderate permeability. Electrical characteristics and applications of the alloys are discussed. CBJ (14b)

Ford Alloy Castings—Copper Used Extensively. R. H. MCCARROLL & J. L. MCCLOUD. *Metal Progress,* Vol. 30, Aug. 1936, pages 33-41. Describes 3 cast irons (approx. 3.25% C) and 5 cast steels used in automotive parts. Their compositions and applications are as follows: For brake drums a cast Fe (3.51-3.40 C, 0.15-0.35 Cr, 0.15-0.35 Ni) was used, the melt containing 15% steel scrap. An alloy cast Fe containing Cu (3.15-3.40 C, 1.80-2.10 Si, 0.50-0.75 Cu) was used for cylinder blocks; the melt containing 20% steel scrap. The same composition modified with 3.30-3.60 C, 1.00-1.25 Ni, 1.40-1.80 Si was used for flywheels, with 5-10% scrap in the charge. The camshaft is a Cu-Cr alloyed Fe (3.30-3.65 C, 0.15-0.35 Mn, 0.45-0.55 Si, 2.50-3.00 Cu, up to 0.25 Cr). Cu helps to control chill in cam points. Of the alloy steel castings, first in order is the low C, Cu alloy (0.15-0.35 C, 0.40-0.60 Mn, 0.60-0.80 Si, 1.50-2.00 Cu) used for clutch pedals. With the C modified to 0.50-0.60 the same composition is used for rear axle housings. The type of alloy steel used for brake drum and wheel hub goes into the higher C range (1.40-1.60 C, 0.70-0.90 Mn, 0.90-1.10 Si, 0.50-2.00 Cu, 0.10-0.20 Mo). The crankshaft steel has the composition 1.35-1.60 C, 0.60-0.80 Mn, 0.85-1.10 Si, 0.40-0.50 Cr and 1.50-2.00 Cu (see *Metals & Alloys,* Vol. 6, Oct. 1935, page 259). For pistons the following alloy steel is used: 1.35-1.70 C, 0.60-1.00 Mn, 0.90-1.30 Si, 2.50-3.00 Cu, 0.08-0.15 Cr; while 1.20-1.40 C, 0.30-0.50 Mn, 0.30-0.60 Si, 2.50-3.50 Cr, 14-17 W and 1.50-2.00 Cu is used for valve seat inserts. WLC (14b)

"Ni-Hard" Rolls for the Metal Trades. A. B. EVEREST. *Sheet Metal Industries,* Vol. 10, June 1936, pages 441-443. Discussion of the advantages of both modified and full "Ni-Hard" rolls over plain chilled cast Fe. AWM (14b)

Combination of Steel and Gypsum Adapted to New Building Material. *Steel,* Vol. 98, June 22, 1936, page 51. Brief description of planks developed by American Cyanamid & Chemical Corp. Consists of gypsum compound bound on sides and ends with galvanized Cu-bearing steel. MS (14b)

New York's New Tri-Borough Bridge Has Silicon Steel Battledeck Floor. *Steel,* Vol. 98, June 15, 1936, page 55. Flooring of lift units consists of 5/8″ Si steel plates covered with 1″ wearing surface of asphalt plank. Plates are welded together by butt welds and to the flanges of the longitudinal floor beams by fillet welds. Tensile strength of welds was 90,000 lbs./in.^{2} and elongation in 2″, 35%. MS (14b)

Steel Bath Tubs Splash for Favor. *Steel,* Vol. 98, June 15, 1936, pages 19-20. Discusses developments in use of enameled pressed steel for plumbing ware. Steel fixtures weigh about 1/3 as much as cast Fe. MS (14b)

Stainless Steel Coach for the Santa Fe. *Railway Mechanical Engineer,* Vol. 110, Mar. 1936, pages 89-93. Gives construction details of a car 79′-8″ long weighing 83,530 lbs. against twice that weight of the ordinary steel car. HA (14b)

Stainless Steel Exhaust Stacks. *Oxy-Acetylene Tips,* Vol. 15, Aug. 1936, pages 178-179. For a 50 ft. stack which had to resist HNO_3, a low C, 18% Cr, 8% Ni steel was welded with Cb-bearing stainless steel welding rods. Ha (14b)

15. GENERAL

Various Methods to Repair Leaky Places in Castings and other Pieces (Verschiedene Verfahren zum Beseitigen von undichten Stellen an Formguss- und anderen Werkstücken) *Giesserei,* Vol. 23, July 31, 1936, pages 386-388. Porous or leaky castings can be made water tight by placing them for a day or two in water or urine to cause them to rust and thus close the openings. A more expensive method is to place the piece in a bath of molten metal under pressure, or, instead of the metal, of Na silicate. Pores in fittings can be closed by pressing PbO_4 or $CaCO_3$ into the pores. To make castings of Mg alloys dense they are advantageously impregnated with an alloy of Sn, Pb, Bi and Cd, e.g. Wood's metal (8 parts Pb, 15 Bi, 4 Sn, 3 Cd) melting point 60° C. The procedures to be used for the different methods are described. Ha (15)

High-Strength Constructional Metals. *Engineering,* Vol. 142, Sept. 4, 1936, pages 256-257. A brief survey of the development of high strength steels and non-ferrous alloys the past few years. Considers a few highly technical surveys contributed on high strength alloys such as Cromansil, Cor-Ten, Sil-Ten, Monel metal, Inconel and others. VSP (15)

Corby Basic Slag Plant. *Engineer,* Vol. 161, June 26, 1936, pages 641-642. Describes the basic slag crushing and pulverizing plant of Stewarts and Lloyd, Ltd., Corby. The plant operates in conjunction with the Bessemer steel plant. Each operation is done automatically, and various grades of ground and pulverized slag are produced. The capacity of the plant is 500 tons/day. VSP (15)

Influence of Excess Tungsten on Pobedit and Substitution of Nickel for Cobalt. G. A. MEERSON, A. M. KOROLKOV, M. M. BABICH & L. P. NEVSKAYA. *Redkie Metallui,* Vol. 5, May-June, 1936, pages 38-46. In Russian. WC alloys were prepared using as binders Co-W alloys containing 0 to 25% W and Ni-W alloys containing 0 to 42% W. The addition of W to the binder increased the hardness and improved the cutting properties. Resistance to transverse stress and density increased up to about 15% W and then decreased. HWR (15)

Prospects of Development of Non-Ferrous Metal Industry of Altai (Russia) S. E. POZIN. *Tzvetnuie Metallui,* No. 6, July 1935, pages 30-32. Detailed discussion of the present status of non-ferrous industry in Altai and the estimated resources of Pb, Zn, Cu and Au ores are given. Plans of developing the district are suggested including the discussion of transportation, power supply, capitalization, and metallurgical processes. BND (15)

15a. Economic

Suggestions for Domestic Materials and Proper Shape of Bearing Metals (Wege zum Heimstoff in Werkstoffauswahl und Formgebung der Lagermetalle) R. KÜHNEL. *Giesserei,* Vol. 23, July 17, 1936, pages 357-363. Under present (German) conditions it is considered necessary to use bearing metals with as little imported metal as possible. The selection of a certain material or alloy according to a formula, $p \times v = c$ (p = pressure, v = velocity), is explained and the possibility of exchanging materials with foreign countries discussed. Ha (15a)

Status of German Metallurgy (Ueberblick über die Versorgung Deutschlands mit Metallen und Erzen) ERNST KORDES. *Chemiker Zeitung,* Vol. 60, Jan. 15, 1936, pages 53-55; Jan. 22, 1936, pages 75-77. German production of metals from their ores is discussed and compared graphically with that of other countries. Germany's production has been second only to American output since 1913. Similar comparative data for recent years are included on Mn, Ni, Cr, Mo, W and V. German resources and production of Cu, Pb, Zn, Sn, Al and other light metals are reviewed. The greatest desideratum for German metallurgy today is stated to be a practical method of producing Al from clay. FPP (15a)

Basic Stages of the Development of Zaporojhstal. I. Z. ROGACHEVSKI. *Kachestvennaia Stal,* Vol. 4, No. 7, 1936, pages 11-16. In Russian. 6 years after designs were approved the plant is less than ½ completed. (15a)

Electricity and Progress in the Steel Industry. L. A. UMANSKY. *Iron Age,* Vol. 138, Sept. 17, 1936, page 34. Brief discussion of the growth and importance of electric power in the steel industry. VSP (15a)

Numerical Treatment of Remelting Orders in the Light Metal Foundry (Die rechnerische Behandlung von Umgussaufträgen in der Leichtmetall-Giesserei) ERICH BECKER. *Aluminium,* Vol. 18, Sept. 1936, pages 436-437. Examples illustrate how the amount of new metal and scrap, loss of metal in melting, and the prices for the new casting are calculated. Ha (15a)

Pig Iron and Ferro-Alloy Industries in 1935—Advance Summary. H. W. DAVIS. *United States Bureau of Mines, Mineral Market Reports* No. M.M.S. 473, July 14, 1936, 4 pages. Statistical. AHE (15a)

Iron Ore Industry in 1935—Final Annual Figures. H. W. DAVIS. *United States Bureau of Mines, Mineral Market Reports,* No. M.M.S. 493, Oct. 15, 1936, 3 pages. Statistical. AHE (15a)

Metal Mining in Utah in 1935. C. N. GERRY & T. H. MILLER. *United States Bureau of Mines, Mineral Market Reports* No. M.M.S. 489, Oct. 6, 1936, 4 pages. Statistical. AHE (15a)

Metal Mining in Washington in 1935. C. N. GERRY & T. H. MILLER. *United States Bureau of Mines, Mineral Market Reports* No. M.M.S. 491, Oct. 13, 1936. Statistical. AHE (15a)

Mine Production of Gold, Silver, Copper, Lead and Zinc in Idaho in 1935. C. N. GERRY & PAUL LUFF. *United States Bureau of Mines, Mineral Market Reports* No. M.M.S. 490, Oct. 13, 1936, 5 pages. Statistical. AHE (15a)

Mine Production of Gold, Silver and Lead in South Dakota in 1935—Advance Summary. CHAS. W. HENDERSON & A. J. MARTIN. *United States Bureau of Mines, Mineral Market Reports* No. M.M.S. 485, Aug. 19, 1936, 1 page. Statistical. AHE (15a)

Mine Production of Gold, Silver, Copper and Lead in Texas in 1935—Advance Summary. CHAS W. HENDERSON & A. J. MARTIN. *United States Bureau of Mines, Mineral Market Reports* No. M.M.S. 486, Aug. 20, 1936, 1 page. Statistical. AHE (15a)

Mine Production of Gold, Silver, Copper, Lead and Zinc in New Mexico in 1935—Advance Summary. CHAS W. HENDERSON & A. J. MARTIN. *United States Bureau of Mines, Mineral Market Reports,* No. M.M.S. 484, Aug. 20, 1936, 2 pages. Statistical. AHE (15a)

15b. Historical

Iron Past and Present. Its Manufacture and Uses. R. LOWE. *Journal & Record of Transactions Junior Institution of Engineers,* Vol. 46, Mar. 1936, pages 263-277. Paper read in London, Dec. 1935, gives historical review dating back to 6000 B.C. Emphasis is placed on modern improvements of cast iron. WH (15b)

Note on a Seventeenth-century Discourse on Tin as a National Asset. S. W. SMITH. *Bulletin Institution Mining & Metallurgy,* No. 384, Sept. 1936, 3 pages. AHE (15b)

The Largest and the Oldest Iron Castings. THOMAS T. REED. *Iron Age,* Vol. 137, Apr. 30, 1936, pages 18-20; *Engineer,* Vol. 162, July 17, 1936, page 60. The largest Fe casting appears to be a lion which still stands in yard of K'ai Yüan monastery, in the ancient city of Ts'angchow, where it was first cast about 1000 years ago. It is about 20 ft. high and 18 ft. long. No information available as to thickness of casting nor as to whether it was cast in one piece. As to the oldest Fe casting it is a sacrificial bowl, dated 615 A.D. Author believes there are numerous Fe castings much older concerning which no information is available. According to literature Fe industry flourished in China in 2nd century B.C. In spite of the belief that casting in Fe originated in Europe in the 14th century, there is some evidence in Greek literature that pouring of Fe was known in the 6th century B.C. VSP (15b)

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WANTED: Man with some experience in the construction of industrial furnaces to take charge of shop and to supervise installation in the field. Give all details and salary expected in first letter. Box MA-22, METALS & ALLOYS, 330 W. 42nd St., New York.

Book Reviews

ELECTRIC ARC WELDING AND ATOMIC HYDROGEN WELDING.

(La Soudure Electrique a l'Arc et la Soudure a l'Hydrogene Atomique) **Maurice Lebrun.**

L'Office Central de l'Acetylene et de la Soudure Autogène, Paris, 1935. Paper, 6¼ x 9¼ in., 173 pages. Price 15 Fr.

This book is a new and enlarged edition of earlier volumes on electric arc welding by the same author, published in 1924 and 1931 respectively. The incessant developments and improvements in arc welding equipment and accessories, as well as in electrodes and their application, have provided ample material for the many new features included.

The first chapter deals with definitions and generalities of the electric arc as used for metallic arc welding and the electrodes employed. Various electrodes and their characteristics are considered in Chapter II. Weld control or examination by radiograph and other non-destructive tests are discussed in the following chapter. Chapter IV deals with the important matter of codes and specifications for arc welding. Next is a chapter on arc welding machines and accessories. Applications of arc welding, taken up in Chapter VI, are gone into at some length. Chapter VII, the final one, deals with atomic hydrogen welding and its applications. A short bibliography is appended.

Highlights of the new book are that it clearly indicates the remarkable extent to which arc welding control has been specified by various regulatory bodies in France during the past few years, and also brings out the extensive developments in structural steel welding, particularly as applied to buildings, bridges and ships. Reinforcement of existing steel bridges by arc welding receives special attention. Arc welded boilers and pressure vessels and welded assemblies fabricated from gas cut plates and shapes are other features of the text. Application of arc welding to various new steels, such as low-alloy high-strength types, is gone into in detail.

In devoting the last chapter to atomic hydrogen welding, the author has not gotten off his subject, inasmuch as this process utilizes an electric arc between tungsten filaments to transform the molecular hydrogen traversing it into atomic hydrogen.—E. V. David.

STANDARD METAL DIRECTORY—1936.

7th Edition. Atlas Publishing Co., Inc., New York, 1936. Cloth, 6 x 9¼ in., 682 pages. Price $10.00.

The 6th edition of this directory appeared in 1931 and was reviewed in Metals and Alloys, Vol. 3, Feb., 1932, page MA29. The various lists are in geographical order under the following main headings: Steel and Metal Manufacturers; Foundries, Ferrous and Non-Ferrous; Forging Manufacturers; Sheet Metal Stamping Plants; Metal Rolling Mills; Aluminum Smelters; Antimonial Lead Smelters; Babbitt and Solder Manufacturers; Ingot Metal Manufacturers; Zinc Smelters; Galvanizing Plants; Die-Casting Plants; Storage Battery Manufacturers; New Metals; Pig Iron, Ores, Ferro-alloys; Scrap Iron and Scrap Metal Dealers; Steel Scrap Exporters; Scrap Metal Exporters; Relaying and Rerolling Rails; Used Pipe Dealers; Used Structural Material Dealers; Automobile Manufacturers; Railroad Purchasing Agents; and Equipment and Supplies for Steel and Metal Works, Foundries, Smelters, Warehouses and Yards.—Richard Rimbach.

TITANIUM OXIDE. *(Titanweiss)*

Kurt Heise.

Theodor Steinkopff Verlag, Dresden, 1936. Paper 6 x 8¾ in. 100 pages. Price 7 RM.

In the few years of its existence, the titanium pigment industry has developed its products to a high degree of perfection. There exists a voluminous patent literature as well as numerous articles in various periodicals, systematic review and classification of which were heretofore attempted, if at all, on a limited scale only; likewise, textbooks dealing with the subject of pigments in general treat titanium pigments in a very superficial manner. The author undertook, therefore, to collect and classify all material available up to the early part of 1935.

The introduction contains a brief historical review of the development of the titanium pigment industry, as well as its present status in various countries. Chapter I deals with raw materials and various processes employed in the manufacture of titanium pigments. Description of these processes is based on available patent literature (United States, German, British, French, etc.); however, no critical evaluation of the processes is attempted. In Chapter II, uses of titanium pigments in various industries are discussed. The field is covered in considerable detail, the major part of the chapter logically being devoted to the application of titanium pigments in paints, enamels, etc. The uses of these pigments in other industries such as synthetic plastics, paper, linoleum, rubber, rayon, ceramics, etc., are also described, mention being made of methods of incorporation of the pigments into various products. At the same time, specifications are given with which the pigments must comply in order to perform satisfactorily in each particular case. The final chapter describes various physical and chemical methods of testing titanium pigments and paints produced therefrom. There is also a brief appendix on the chemistry of titanium. Each chapter is accompanied by extensive bibliographies. J. L. Turner. *(Reprinted by permission from Industrial & Engineering Chemistry, July 10, 1936).*

DIE CASTING. Charles O. Herb.

Industrial Press, New York, 1936. Cloth, 6 x 9¼ in., 300 pages. Price $3.00.

The substantial increase in the use of die castings during the past few years is familiar to most engineers and designers. Few, however, realize the complexity of the problems of die design which the many unusual shapes have introduced. Mr. Herb has, in this book, revealed the full scope of the ingenuity of the die casting engineer in solving the many unusual problems with which he has been confronted.

The writer reviews briefly the process itself and the machines and alloys used. The main body of the book is taken up with the subject of die design in all of its many ramifications. It is impossible in the scope of a brief review to cover the many details which Mr. Herb has considered. Each type of die is carefully described with the aid of working drawings and in many cases with photographic illustrations of the actual dies themselves. The design engineer who reads the book carefully will have a clear idea of the steps through which the die caster must go to produce a die for the casting of a particular object.

In the latter portion of his book, Mr. Herb treats some of the newer methods of casting alloys of high melting point. The so-called brass die casting and vacuum casting processes are described in some detail. A short chapter on die casting of cast Fe completes the book.

"Die Casting" covers a specialized portion of the field of die casting but is nevertheless a welcome addition to the altogether too scanty literature on this important subject.—E. A. Anderson.

CHROMIUM PLATING. E. S. Richards.

2nd Edition. J. B. Lippincott Co., Philadelphia, 1936. Cloth, 7½ x 7¾ in., 131 pages. Price $3.50.

This small book is written primarily for the practical electroplater, giving quite detailed comments on cleaning deposition and polishing of preliminary coats of other metals, wiring of the work, positioning anodes and that sort of thing. French and English baths and practice are compared. Batch processes are chiefly featured; the author does not consider Cr barrel plating perfected as yet. One continuous (rotary) Cr plating outfit is described and illustrated.

The use of copper-copper oxide rectifiers instead of generators as current-source for plating is recommended for new plants.—H. W. Gillett.

GALVANIZING. Heinz Bablik.

Translated by MARGARET JUERS-BUDICKY. *Chemical Publishing Co., New York, 1936. Cloth, 5½ x 8½ in., 367 pages. Price $8.00.*

The book is the outgrowth of a previous smaller one by the author on the same subject, 1924, translated 1926. Of the five chapters in the book, Hot galvanizing, Electro-galvanizing, Sherardizing, The Spraying Process, and Testing and Judging Galvanized Coatings, the first overshadows all the rest, over 70 per cent of the space being devoted to this. This includes, however, discussions on pickling and fluxing. The book is largely a compilation of the published information on the subject and American readers will naturally take pride in the outstanding number of references to American work in this field. In fact, as a foreign publication, dealing with a technical process, the book is somewhat disappointing in that it does not give a picture of foreign practice and technique.

A particularly noticeable illustration of this is the list of standards appended. This list comprises four British standards, presumably those of the British Engineering Standards Association, and 11 of the American Society for Testing Materials, erroneously given, however, as "U. S. A. Standards."

The style of the translation, especially those portions dealing with the more basic features of the process, is often extremely awkward. The contrast with the crisp precise style which is favored in American technical writing is so marked, that it may distract the reader's attention away from the "meat" of the discussion. Complicated sentences abound, such as the following, relating to the scaling of steel during hot working:

"In order to limit the mechanically exerted pressure to a bearable amount, a part of the energy necessary for the displacement of the particles with respect to one another is applied in the form of thermal energy. This higher temperature possessed by the iron represents a condition of increased lattice mobility and thus an increased reactivity which, in view of the oxygen taking place in the reaction, is fulfilled on the surface by the formation of scale."

American readers may consider the chapter on electrogalvanizing rather brief and incomplete. The important advancements in this line have been so recent, however, that apparently they could not be included. The chapters on sherardizing and metal spraying, although still shorter, are adequate in view of the limited use of these methods. It is disappointing, however, to find in the chapter on Testing and Judging Coatings, no recognition of the method of evaluating coatings by continuous exposure to the weather. The marked trend in this direction in this country in various lines of corrosion study makes this omission still more obvious.

Despite what has been said, the present reader considers the book a valuable one in this field of metallurgy and can strongly recommend it to those interested in the zinc-coating of steel and its utilization as a preventive against corrosion.—H. S. RAWDON.

PRACTICAL TREATISE ON HOT GALVANIZING. *(Traite Pratique de Galvanisation a Chaud).* Jean Chambran.

Editions de l'Usine, Paris, 1936. Paper, 6 x 9¼ in., 137 pages. Price 24 Fr.

The reviewer would express at the outset his regret that there is not available a book in English, the equivalent of this practical treatise on "Hot Galvanizing." The subject matter of the book has previously appeared in the columns of the industrial and metallurgical journal, "L'Usine." The first part, consisting of four chapters, covers the principles of hot galvanizing; the second part (three chapters) discusses mechanical hot-galvanizing; the third part (one chapter) hot-galvanizing by hand, and the fourth part (one chapter), operations for fashioning galvanized materials, sheets and wire, by bending, corrugating, etc. A short appendix is devoted to galvanizing by the metal-spraying process.

The book gives a good picture of French installation and practice and presumably the practical American galvanizer would find numerous details differing from his own methods. However, most of the discussion is applicable to galvanizing in general. A feature of the book which appeals particularly to the reviewer is the concise method of presentation. All "padding" has been eliminated. As is the case with many foreign books, there is much to be desired in the mechanical make-up of the book. Although well printed on a fair grade of paper, the weak binding and the paper covers do not contribute much to the permanency of the book.—H. S. RAWDON.

ELECTRIC ARC WELDING PRACTICE. H. I. Lewenz.

Crosby Lockwood & Son, Ltd., London, 1936. Cloth, 5½ x 8¾ in., 126 pages. Price 8s. 6d.

This booklet of 126 pages costing in this country something over $2.00 covers a number of subjects, from the introduction to the different methods of welding down to materials with their weldability, electrodes, process of metallic arc welding, type of joints, stresses, welding of cast Fe and testing and something of applications. There are also some useful tables included. In the limited number of pages available, the author covers considerable territory, consequently, cannot give as much detailed information as might be desired, for example, type of welded joint as well as stresses and deformation with stress distribution.

The book is easily read, containing a number of illustrations, drawings and charts, and contains a well arranged index.—A. F. DAVIS.

THE TECHNOLOGY OF ALUMINUM AND ITS LIGHT ALLOYS.

A. von Zeerleder.

Translated from the 2nd German Edition by A. J. FIELD. *Gustav Fock, New York, 1936. Cloth, 6¼ x 9¾ in., 300 pages. Price $5.50.*

It is a pleasure to read a translation from the technical German which runs as smoothly as does this work of A. J. Field. The translator has made a particular effort to use the exact English equivalent of every technical term and his familiarity with the subject has stood him in good stead.

Zeerleder has attempted to cover a very broad field in 300 pages and the treatment is necessarily sketchy in parts. In general, the book expresses European practices and viewpoints. The European practice of naming alloys has led to a multiplicity of alloy names, not always easily identifiable. This book carries 14 pages of these alloys, arranged in tabular form with information regarding composition and properties, which is valuable for reference purposes. The section on casting methods is interesting and well illustrated. The information on aluminum paint, to cite another example, however, is quite inadequate and the vehicle recommended was out of date years ago. Any aluminum metallurgist will find things of interest in this volume and should be familiar with its contents.—J. D. EDWARDS.

CHEMICAL ENGINEERING CATALOG 21st Edition.

Reinhold Publishing Corporation, New York, 1936. Cloth, 8½ x 11¼ in., 913 pages. Price $10.00, except to special classes of technical men to whom it is lent gratis or sold for $3.00.

Autumn rolls around again and with it comes the 21st Annual Edition of the Chemical Engineering Catalog, containing even more pages of data from the firms who use this means of bringing their products to the attention of prospective purchasers. It has always been the policy of the publishers to encourage the advertisers to give detailed and actually useful information about their products so that each year the Catalog comes nearer to its goal: An absolutely complete and reliable source of information for the whole group of process industries.

The sections of the Catalog are the same this year as last, namely: Trade Name Index, Equipment and Supplies, Chemicals and Raw Materials (subdivided into Industrial Chemicals and Laboratory Chemicals), and the Technical and Scientific Book Section. The detailed indexes and careful cross-indexing make the volume easy to use.—M. L. MOORMAN.

FOUNDRY WORK. R. E. Wendt.

3rd Edition. McGraw-Hill Book Co., New York, 1936. Cloth, 5 x 7¾ in., 240 pages. Price $2.00.

An elementary text book. Each chapter is followed by a list of questions. Molding and core making are gone into in some detail, but the only melting process to which much space is given is cupola melting of gray iron. The nonferrous chapter is very sketchy, while steel and malleable receive bare mention only. The book is much more about molding than about metallurgy. Though built on the author's experience in teaching engineering students at Purdue, it seems to be written primarily for use in trade schools.—H. W. GILLETT.

CORROSION RESISTANCE OF METALS and ALLOYS

By Robert J. McKay and Robert Worthington

Practical information on the lasting powers of the common Metals and Alloys, for the Engineers—Chemical, Metallurgical, Mechanical, Civil, Electrical, Hydraulic, etc.

A. S. C. Monograph, 492 pages, 64 diagrams, 364 tables, 12 photographs, $7.00

ALL who have to do with metals—producers, manufacturers, distributors and users—find themselves faced with corrosion problems. This book was written primarily to provide help to a man in this situation.

The total annual loss from corrosion is tremendous.. In one case the wrong use of metal led to the scrapping of several hundred thousand dollars worth of equipment inside a month or two, in another the loss was nearly as great. These losses would have been entirely avoided if one or two perfectly simple facts of corrosion had been understood. Losses on a minor scale, due to lack of understanding, are innumerable. Corrosion can be made an extremely complicated subject. The authors have not let it become so in this book. They have taken as the basis of discussion the simple facts of what a corrosive will do to metals or how a metal will behave in the face of corrosives. Insofar as possible they have expressed this behavior in quantitative terms. Involved discussion of the theories of corrosion have been avoided, yet enough of this has been included to provide background. The approach is essentially a practical one.

Corrosion knowledge is rapidly increasing. It is believed that the present work of 492 pages may serve for years to come as a pattern into which each newly discovered fact may be fitted and which thus may provide this fact with its true and usefulinterpretation.

CONTENTS—Covering the entire 16 groups of Metals

PART I—GENERAL AND THEORETICAL

INTRODUCTORY

THE RATE FACTORS—Acidity—Oxidizing agents (air)—Movement—Electrolytic effects—Solid films—Temperature.

FORMS OF CORROSION—Direct chemical—Pitting—Two-metal galvanic action—Concentration cell or solution cell—Relation of galvanic to concentration or solution cell corrosion—The concentration or solution cell principle—Corrosion cell pitting—Effect of corroding film (film cells)—Dezincification—Corrosion-cracking-fatigue

CORROSIVES—Corrosion by air—Corrosion in soils—Corrosion by acids—Oxidizing agents—Natural waters—Chemical salts and brines—Organic compounds and food products—High temperature oxidation—Sulfur compounds—Alkalies

METAL CORROSION PROPERTIES—Chemical affinity and solution pressure—Oxidation passivity—Corrosion product properties—Composition and homogeneity—Strains—Surface

PART II—CORROSION BEHAVIOR OF SPECIFIC METAL AND ALLOY GROUPS

INTRODUCTORY

MAGNESIUM AND ITS ALLOYS—The protective oxide—Two-metal galvanic behavior—Pitting—Atmosphere—Protection—Salt Water—Fresh water—Acids

ALUMINUM AND ITS ALLOYS—Test method considerations—Influence of alloying elements—Intercrystalline corrosion—Localized action—Effect of stress—Two-metal galvanic behavior—Protective methods—Atmosphere—Waters—Salt solutions—Food products—Acid solutions—Alkaline solutions—High temperatures

ZINC AND ZINC COATINGS—Types of zinc coatings—General corrosion resistance—Impurities in zinc—Nature of zinc coatings—Testing coatings—Galvanic corrosion—Defining non-corrosive neutral range of aqueous solution—Acid conditions—Alkaline solutions—Neutral solutions—Food products—Toxicity—Atmosphere—High temperature

CADMIUM PLATE

TIN AND TIN PLATE—The Tin Can—Oxidizers—Polarity—Effect of acidity—Temperature—Enameled cans—Tin pickup and Toxicity—Inhibitors and accelerators—Containers used for food products—Acids—Food products other than in the tin can—Alkaline solutions—Salt solutions—Waters—Atmosphere—High temperature gases

LEAD—Corrosion resistance: general—Embrittlement—Two-metal galvanic behavior—Acids—Caustic alkaline solutions—Aqueous ammonia—Neutral solutions—Atmosphere—Contact with concrete—High temperatures

IRON AND STEEL—Corrosion resistance; general—Aqueous conditions—Neutral solutions—Mechanism—Air-free solutions—Variation of attack with constituents in solution—Comparison of types of ferrous metals—Deaeration—Deactivation—Sea Water—Boiler corrosion—Underground waters—Food products—Atmospheres—Stress accelerated corrosion—Acids—Alkaline solutions—Two-metal galvanic behavior—High temperature conditions

SILICON IRON

MOLYBDENUM ALLOYS—General—Hydrochloric acid—Sulfuric acid—Phosphoric acid—Wet chlorine

CHROMIUM ALLOYS—Corrosion resistant alloys—Heat resistant alloys—Passivity-activity—Intergranular disintegration—Acids—Caustic alkalies—Ammonia solutions—Salt solutions—Waters—Food products—Atmospheres—High temperature conditions—Oxidizing gas without sulfur—Oxidizing gas carrying sulfur—Reducing gas carrying sulfur—Ammonia at high temperatures—Carburizing boxes—Steam—Molten metals—Fused compounds

CHROMIUM PLATE—Structural considerations—Passivity—Two-metal galvanic corrosion—Aqueous conditions—Elevated temperatures

NICKEL - IRON ALLOYS—General—Acids—Neutral solutions—Alkaline solutions—Atmospheres—High temperatures

NICKEL—Nickel-plate—Stress accelerated corrosion and corrosion fatigue—Two-metal galvanic behavior—Acids—Alkaline solutions—Salt solutions—Atmospheres—Waters—Steam—Food products—High temperature atmospheres—Miscellaneous substances

NICKEL COPPER ALLOYS—Two-metal galvanic corrosion—Acids—Salt solutions—Waters—Food products—Atmosphere—Steam—High temperature atmospheres—Miscellaneous substances

COPPER—Solubility of copper compounds—Two-metal galvanic behavior—Acids—Alkaline solutions—Food products—Waters—Atmospheres—High temperature conditions—Miscellaneous substances

HIGH COPPER ALLOYS—BRASS, BRONZE NICKEL-SILVER—Two-metal galvanic behavior—Corrosion cracking of brass—Corrosion and fatigue—Acids—Caustic alkaline solutions—Ammonium hydroxide—Salt solutions—Waters—Atmosphere—High temperatures

INDEXES—AUTHOR, SUBJECT

REINHOLD PUBLISHING CORPORATION,

330 West 42nd Street
New York, U. S. A.

Current News Items

A.F.A. Announces Organization Change

As the first step in a program of broadening both its scope of activities and its responsibilities as a national association of the foundry industry, the executive committee of the board of directors of the American Foundrymen's Association, at a recent meeting in Chicago, elected C. E. Hoyt for the past 18 years executive secretary-treasurer, to the position of executive vice president in accordance with the recent revision of the by-laws creating the office of executive vice president.

At the same meeting, Dan M. Avey, formerly vice president and director of the Penton Publishing Co. and editor of *The Foundry,* was elected secretary-treasurer, effective Jan. 1, 1937.

In his new position, Mr. Hoyt will continue as the executive officer of the Association, directing efforts toward broadening the field of service of the A.F.A. Mr. Avey's election to the secretary-treasurership will not only strengthen the official staff but will make available to the foundry industry through the A.F.A. the services of one who, as editor of *The Foundry* and an active participant for many years in Association work, has an intelligent understanding of the problems and ramifications of the industry, a rare executive ability, and the determination to help the foundry industry to meet and solve its problems, and move forward.

This broadening of the organization, leading to new fields of activities is the culmination of a series of developments emanating from a joint meeting of directors and members of the advisory board at the annual convention in Detroit last May. This meeting was devoted to a discussion of methods for broadening the scope and responsibilities of the Association, resulting in action and authorization at the annual business meeting for the appointment of a special committee on policies and activities composed of a representative from each of the four branches of the industry and one from the foundry equipment industry.

International Exchange Paper Authors for A.F.A.

The American Foundrymen's Association has selected O. W. Ellis and W. Paul Eddy, Jr. as exchange authors for the 1937 meetings of the British and French foundry associations respectively.

Mr. Ellis, director of metallurgical research, Ontario Research Foundation, Toronto, will present the exchange paper before the Institute of British Foundrymen. Mr. Eddy has undertaken to prepare the paper for the annual meeting of the French Association, known as the Association Technique de Fonderie.

● J. E. Tobey, manager, fuel engineering division, Appalachian Coals, Inc., is the new chairman of the Ohio Valley Section, American Institute of Mining and Metallurgical Engineers, having been elected at the recent annual meeting held in Columbus, Ohio. Formerly the Ohio Section, including only A.I.M.E. members from this state, the Ohio Valley Section now also embraces membership from parts of Indiana, Kentucky, and West Virginia. Byron Bird, chief concentration engineer, Battelle Memorial Institute, Columbus, Ohio, is secretary of the Ohio Valley Section of A.I.M.E., having been re-elected at the last annual meeting.

Metal Congress for 1937 in Atlantic City

The 1937 Metal Congress and Exposition will be held Oct. 18 to 22, in the Atlantic City Auditorium, Atlantic City, N. J. This important metal event has been staged and sponsored for 18 successive years by the American Society for Metals. It is one of the oldest and most popular industrial expositions in the country.

It is pointed out that it has been the practice to hold the exposition in a different section each year. In 1935, the show was staged in Chicago, in 1936 it was in Cleveland, and in 1937, the schedule called for a visit to the East. Atlantic City was selected by the board of trustees of the society because of its marvelous auditorium and convenient and adequate hotel facilities. The huge Auditorium offers every facility for making this Nineteenth Annual Metal Exposition the largest and most attractive ever presented to the thousands of metal men whose job it is to solve the world's metal problems.

Perkin Medal to Thomas Midgley, Jr.

The Perkin Medal for 1937 was presented Jan. 9 to Thomas Midgley, Jr. of the Ethyl Gasoline Corp. at a joint meeting of the American Section of the Society of Chemical Industry and the American Chemical Society, held at The Chemists' Club, New York. James G. Vail, chairman, presided. The program included a talk by Robert E. Wilson on the accomplishments of the medalist, presentation of the medal by Marston T. Bogert and delivery of the medal address by Thomas Midgley, Jr. Mr. Midgley discussed the use of the periodic table in the research which led to the development of antiknock gasoline and organic fluoride refrigerants. His paper was entitled "From the Periodic Table to Production."

Oil Burning and Air Conditioning Exposition

Organization of the National Oil Burning and Air Conditioning Exposition, to be held in Philadelphia March 15 to 19, has progressed rapidly. Even at this early date success is assured, according to G. Harvey Porter, managing director of the Oil Burner Institute and also of the exposition committee. Displays will feature the newest oil burner, distillate and air conditioning equipment produced by leading manufacturers for domestic, commercial and industrial application. Fuel oil companies and accessory manufacturers will also show. Commitments have been signed by 25 manufacturers for 77 spaces representing over 40 percent of the available booths.

● George H. Weiler has recently become associated with the Vanadium Corp. of America as manager, Eastern Railroad Division, with headquarters in New York. For a number of years Mr. Weiler was sales manager of the American Locomotive Co., of New York; later secretary-manager of the Forging Manufacturers' Association, New York, and more recently was connected with the Standard Steel Works Co., Burnham, Pa. The addition of Mr. Weiler to the staff of the Vanadium company serving the railroad industry is part of an expanded program of metallurgical assistance being offered in this field.

Research on Tire Chains at Mellon Institute

An industrial fellowship that is investigating broadly the durability of automotive tire chains has been founded at Mellon Institute of Industrial Research by The McKay Co. of Pittsburgh, which manufactures commercial chains of all types. This fellowship, which began operation on Sept. 15, 1936, has for its objective the production of better chains, particularly for the motorist. A comprehensive program of basic research is being carried on, including studies of the design, materials, processes of manufacture, and testing of chains.

The McKay Fellowship is headed by Dr. David F. Helm, who received his professional education at Denison University (A.B., 1928), Michigan State College (M.S., 1930), and Ohio State University (Ph.D., 1934). Prior to joining the research staff of Mellon Institute, Dr. Helm was employed as research engineer on cast iron metallurgy in the Engineering Experiment Station of the Ohio State University; previously he was a chemist with the Midgley Foundation, Columbus, Ohio.

Research Foundation Incorporated

Organization of the Ohio State University Research Foundation was announced Tuesday as incorporation articles were filed in the office of Secretary of State George S. Myers. Incorporators are: Charles F. Kettering, Daytona, president of General Motors Research Corp.; James R. Lincoln, Cleveland, president of Lincoln Electric Co.; Charles E. MacQuigg, metallurgical engineer and manager of the Union Carbide and Carbon Research Laboratories; Julius F. Stone, chairman of the university's board of trustees and a prominent Columbus industrialist, and Charles F. Michaels Bucyens, president of Ohio Locomotive Crane Co. and president of Ohio Manufacturers' Association.

Hurlbut S. Jacoby, director of industrial research at Ohio State University since Jan. 1, 1935, is named as the corporation's agent.

Articles of incorporation set forth that the corporation is not for profit, and it is added that none of the incorporation and those to be announced later as "members" of the corporation will receive remuneration in the form of royalties or other compensation resulting from the foundation's activities.

"Basic objective of the foundation," Mr. Jacoby explains, "is to provide an instrument with which the university can work in closer relationship with industries, especially those of Ohio, in solving their research problems."

Stainless Steel Wire in Automobile Wheels

A substantial increase in the production of stainless steel wire by the wire division of Firth-Sterling Steel Co., McKeesport, Pa., has resulted from the adoption of steering wheels with wire spokes by a large number of automobile manufacturers, L. Gerald Firth, president, has announced. Since each steering wheel of the most generally used design requires 15 spokes made of a specially treated stainless steel, this division of the company is working full time.

The new wire spoke steering wheels have become standard equipment on many 1937 models and optional equipment on the major number of cars. They are designed to reduce road vibration and to add to appearance, and since they are unlikely to break in an accident, they provide an added safety feature.

● The Latrobe Electric Steel Co., Latrobe, Pa., announces that the International Nickel Company has just concluded a license, for the United States and foreign countries, to make, use, and sell under the Armstrong patents Nos. 1,997,538 and 2,044,742 for the manufacture of clad products, plates, sheets, etc., using the electrolytic iron bonding or welding method, which process has been used by the Latrobe company for the past few years, and recently by Jessop Steel Co.

Dr. Bass Rejoins Mellon Institute

Dr. Lawrence Wade Bass has been appointed a member of the executive staff of Mellon Institute of Industrial Research, Pittsburgh, according to an announcement of that institution. Dr. Bass served as executive assistant at Mellon Institute during the period 1929 to 1931 and is returning to that organization as assistant director after being connected with the Borden Co., New York, for 6 years, first as assistant director of research, then, since 1932, as director of research. He assumed his duties at the Institute on Jan. 1, 1937.

Dr. Bass, who previously distinguished himself by his researches in organic chemistry and biochemistry, has been devoting special attention to industrial research management and chemical economics. He is a member of the American Association for the Advancement of Science, American Academy of Political and Social Science, American Chemical Society (chairman, New York section, 1936), American Dairy Science Association, American Economic Association, American Institute of Chemical Engineers (director, 1937), American Institute of Chemists, American Public Health Association, American Statistical Association, Pennsylvania Academy of Science, Pittsburgh Personnel Association, and Society of Chemical Industry. He is also a member of the Sigma Nu, Sigma Xi, Alpha Chi Sigma, and Phi Lambda Upsilon fraternities, and of the Yale and Chemists' Clubs of New York, the University Club of Pittsburgh, and the University Club of Syracuse. He has made many important contributions to chemical literature.

Exhibition of Applied and Scientific Photography

Under the chairmanship of Gustave Fassin, of the Bausch & Lomb Scientific Bureau, Rochester, N. Y., a committee has been appointed to secure and arrange exhibits for the first International Exhibition of Applied and Scientific Photography ever held in the United States. According to plans revealed by Mr. Fassin and Rowland S. Potter, national chairman of the scientific and technical section of the Photographic Society of America and president of the local section of the society, which is sponsoring the exhibition, it will be held in the Rundell Memorial Building at Rochester in March, 1937. This new and beautiful civic building has exceptional facilities for showing both pictures and apparatus.

● Cornelius F. Kelley, president of the Anaconda Copper Mining Co., has accepted appointment as chairman of the committee of members of the non-ferrous metals industry which will participate in the campaign to sell $27,829,500 of debenture bonds to finance construction of the New York World's Fair, Richard Whitney, chairman of the World's Fair bond sales committee, has announced. The committee which Mr. Kelley will head is one of 68 volunteer groups representing trade and industry organized by the New York World's Fair bond sales committee. Several sub-committees may be created, each to be headed by a vice-chairman and concerned with a particular division of the industry. Among those considered are a copper division, a tin division, and aluminum division and other similar groups. The Fair opens April 30, 1939, the 150th anniversary of the inauguration of George Washington as president.

● Appointment of A. C. Wilby as manager of public relations for the Chicago district was announced yesterday by B. F. Fairless, president of the Carnegie-Illinois Steel Corp. Mr. Wilby for a number of years has been assistant to President of the Universal Atlas Cement Co., a subsidiary of the United States Steel Corp. A similar department of public relations has been established in the Pittsburgh district with William Voigt, Jr., in charge. Mr. Voigt was Pittsburgh correspondent of the Associated Press before coming to Carnegie-Illinois.

Photoelectric Pyrometer Application Improves Mill Yield at Bethlehem's Saucon Plant

A photoelectric pyrometer, applied to a 48-in. shape mill in the Saucon Plant of the Bethlehem Steel Co., is making it easier for the operators to obtain more nearly perfect duplication of sections, by providing them with constant, accurate indication of the temperature of the bar being rolled, and is thus contributing to improved mill yield, according to A. J. Standing, superintendent of the company's electrical department.

In making the application, particular attention was paid to the problem of obviating the interference caused by scale on the bars and by steam or water vapor surrounding the bars. These objectionable factors were eliminated by mounting the phototube sufficiently remote from the mill to avoid the steam disturbance and by focusing the tube on the center of the flange of the bar which, being in a vertical plane approaching the mill, is generally free from scale and water.

The installation consists of a General Electric "PJ-22" phototube in a dust-tight cast-iron holder with a light tunnel and adjustable aperture, together with a G-E type "CR7505 Pliotron" amplifier used for boosting the output of the phototube sufficiently so that it will actuate an indicating ammeter that is calibrated in degrees Fahrenheit of the heated body. The calibration is made by checking against an optical pyrometer at given points on the scale. The amplifier panel is mounted on the building wall in order to protect it from undue heat and vibration. The indicating instrument, however, is mounted in the roller's pulpit in full view of the operators so that they may be guided by its indication of the temperature of the bar entering the mill in adjusting the screwdown controls.

The operating results have been successful, according to Mr. Standing, and the improved mill yield resulting from the accuracy of section being rolled has justified the application. "We have," he states, "every reason to expect sustained improvement in mill operation by reason of the precise knowledge of the temperature of the steel being rolled."

Changes in Grade Designations Silcrome Stainless Steel

Effective immediately, the Ludlum Steel Co., Watervliet, N. Y., is changing the grade designations of part of its chrome nickel "Silcrome" series so that in the future its stainless grades will be designated by numbers indicating as closely as possible their composition. The following changes have been announced:

Old Designation	New Designation
Silcrome KA2	Silcrome 18-8
Silcrome KA2-S	Silcrome 18-8-S
Silcrome KA2-T	Silcrome 18-8-T
Silcrome KA2-C	Silcrome 18-8-C
Silcrome KA2-MS	Silcrome 18-8-M
Silcrome KA2-EZ	Silcrome 18-8-EZ

Designations of grades not listed above remain unchanged.

Foxboro Adds to Personnel

Walter N. Stancati has joined the staff of the Pittsburgh office of The Foxboro Co., Foxboro, Mass., makers of industrial precision instruments. Mr. Stancati will work out of Pittsburgh as a sales engineer. Frank H. Herman has been added to the personnel in the repair shops of Foxboro's Pittsburgh office. Roger W. Allen has been appointed as sales engineer in the Atlanta, Ga., office of the company. T. R. Smiley has been added to the personnel in the repair shops of the San Francisco office.

● Clyde E. Williams, director, Battelle Memorial Institute, Columbus, Ohio, has announced the appointments of Dr. C. A. Barnes, J. M. Pilcher and Tom Barlow to the technical staff. Mr. Pilcher and Dr. Barnes have been assigned to the fuels division and Mr. Barlow to the division of process metallurgy at the Institute.

Fifth International Congress for Applied Mechanics in 1938

The American committee, to whom has been delegated responsibility for organizing the Fifth International Congress for Applied Mechanics by the international committee at its meeting at Cambridge University, England, in July, 1934, announces that the fifth congress will meet in Cambridge, Mass., September 12 to 16, 1938, at Harvard University and the Massachusetts Institute of Technology. As in the past, this Congress is to be a meeting of persons working in the field of Applied Mechanics before whom reports of recent work may be presented for discussion.

The program will cover three main divisions of Applied Mechanics as follows: (1) Structures, elasticity, plasticity, fatigue, strength theory, crystal structure; (2) hydro and areodynamics, gasdynamics, hydraulics, meteorology, water waves, heat transfer; and (3) dynamics of solids, vibration and sound, friction and lubrication, wear and seizure.

Following the meeting at Cambridge, it is expected that arrangements will be made to visit Washington (National Bureau of Standards), and Langley Field (National Advisory Committee for Aeronautics). Dormitory and boarding facilities will be made available by Harvard University. Inquiries should be addressed to the Fifth International Congress for Applied Mechanics, Massachusetts Institute of Technology, Cambridge, Mass.

Editor Morrow Joins Corning Glass Works

Leslie W. W. Morrow, for the past ten years editor of *Electric World,* has been appointed general manager of the new Fibre Products Division of the Corning Glass Works, Corning, N. Y. Mr. Morrow has resigned from the McGraw-Hill Co., and has relinquished his post as editor to assume the duties of his new assignment. He will be located at Corning, N. Y. The Fibre Products Division, an important new division of the Corning Glass Works, has been in operation only since May of the present year. An entire new factory equipped with the new glass walls instead of windows, has been built at Corning to accommodate the work of this division. Already fibrous glass is widely used as a heat insulator for buildings, ships, and mechanical refrigerators, but its unusual chemical and physical characteristics suggest infinite applications for both home and industry of the future. Experiments indicate that within a short span of years all of the woven insulation on electric cable and wire may be glass fibre, the material being impervious to moisture and showing no appreciable deterioration with time. Potential importance of the new fibrous glass in the electrical field makes Mr. Morrow's appointment one of especial significance. He will bring to the new work his wide knowledge of electrical engineering and its applications. His experience has been compounded of practical contact with every branch of the electrical industry.

● Calvin A. Hooker, 202 Forest Avenue, Royal Oak, Mich., has been appointed representative of the Ajax Electric Co., Inc., in the Michigan and Western Ohio territory.

● The Lindberg Engineering Co., Chicago, announces the opening of two new sales offices, one at 90 West Broadway, New York, with Lawrence W. Hayden as manager, and one at 503 Illinois Building, Indianapolis, with Grant Goodwin in charge.

● The following officers were recently appointed by the board of directors of the General Refractories Co., Philadelphia: Lionel Y. Greene, vice president in charge of operations; Russell P. Heuer, vice president in charge of research, and Drew M. Thorpe, vice president in charge of sales.

MANUFACTURERS' LITERATURE

Improved Pot Hardening Furnaces

A leaflet devoted to these furnaces which have among their new features an insulating refractory lining backed by block insulation, heat-resisting alloy burners and single valve control, has been issued by the American Gas Furnace Co., Elizabeth, N. J. (B 52)

Special Atmospheres in the Heat Treatment and Brazing of Metals

A reprint of the above article by C. L. West, Research Engineer, is offered by The Electric Furnace Co., Salem, O. (B 53)

Car Hearth Furnaces

Bulletin C-736 is devoted to these furnaces which were designed for uniform heating, sturdy construction and fuel economy. The Philadelphia Drying Machinery Co., Philadelphia, Pa. (B 54)

Chain and Belt Conveyors

Bulletin 1-B discusses conveyors for use at high temperature. Michigan Steel Casting Co., Detroit, Mich. (B 55)

Industrial Uses for Micarta

Mechanical and electrical properties of micarta and the standard forms available, are given in a colorful brochure. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. (B 56)

Heat in Industry

A well illustrated booklet entitled "Wherever Heat is Used in Industry" gives a picture of this company's products and service. Surface Combustion Corp., Toledo, O. (B 57)

Furnaces

Information concerning Hausfeld modern melting equipment for die casting is featured in an illustrated leaflet. Campbell-Hausfeld Co., Harrison, O. (B 58)

What Scientists Say of Leitz Ultropak

Bulletin No. 17 describes the personal experiences and applications to which Ultropak has been placed by scientific workers in various fields. E. Leitz, Inc., New York, N. Y. (B 59)

High Temperature Insulation

For all types of heated equipment is the subject of an illustrated leaflet issued by Armstrong Cork Products Co., Lancaster, Pa. (B 60)

Potentiometer Control Pyrometer

The principles, operating details and methods of application of the Stabilog Potentiometer Control Pyrometer are described in Bulletin 194-1. The Foxboro Co., Foxboro, Mass. (B 61)

Braze-Rite Furnace

This furnace, developed principally for brazing sintered carbide cutting tools, provides for localized heat to be applied only to the portion of the tool to be brazed. Firth-Sterling Steel Co., McKeesport, Pa. (B 62)

High Frequency Electric Power Converters

According to illustrated pamphlets, this company manufactures high frequency electric converters for use in conjunction with numerous industrial induction heating applications. Lepel High Frequency Laboratories, Inc., New York, N. Y. (B 63)

Industrial Products

The 1936 edition of this catalog contains information and recommendations on high and low temperature insulations for every industrial need. Illustrated Johns-Manville, New York, N. Y. (B 64)

Salt Bath Furnace

The Ajax-Hultgren electrically heated salt bath was designed to meet the metallurgical requirements of liquid heat treating operations. Bulletin 103 lists some of the advantages of the furnace. Illustrated. Ajax Electric Co., Inc., Philadelphia, Pa. (B 65)

Sixteen Sins of the Cleaning Room

Are listed in a circular for convenience in checking on cleaning rooms. Great Lakes Foundry Sand Co., Detroit, Mich. (B 66)

Stainless and Heat-Resisting Steels

A colorful booklet devoted to the Enduro line of steels illustrates many of the applications. Republic Steel Corp., Massillon, O. (B 67)

Extensometer

The Kenyon-Burns-Young extensometer is described and illustrated in Bulletin 128. Baldwin-Southwark Corp., Philadelphia, Pa. (B 68)

Fire Clay Products

A folder contains brief descriptions of the Goose Lake products and Therm-O-flake (for high temperature insulation) products. Illinois Clay Products Co., Joliet, Ill. (B 69)

Mallory Elkon

Looseleaf catalog containing engineering data with descriptions, illustrations and recommendations for the selection of electrical contacts for all types of service. P. R. Mallory & Co., Inc., Indianapolis, Ind. (B 70)

Optical Pyrometer

The Burrell optical pyrometer, a direct reading instrument is described and illustrated in a leaflet published by the Burrell Technical Supply Co., Pittsburgh, Pa. (B 71)

Aerocase

Booklet on this subject. Illustrations, curve charts, tables. American Cyanamid and Chemical Corp, New York, N. Y. (B 72)

Sand Control in the Foundry

A colorful pamphlet lists the major causes of casting defects and inferiorities and states that they may be avoided by the use of the proper sand control equipment. Illustrated. Harry W. Dietert Co., Detroit, Mich. (B 73)

Properties of OFHC Copper

An attractive booklet contains reprints of three papers relating to the above subject. United States Metals Refining Co., New York, N. Y. (B 74)

Superficial Hardness Tester

Catalog Supplement RS-3 is devoted to this hardness tester, which is a special purpose machine, intended exclusively for hardness tests where only very shallow penetration is possible and where it is desired to know the hardness of the specimen close to the surface. Wilson Mechanical Instrument Co., New York, N. Y. (B 75)

Rocking Furnace

Type G-M is a small-scale indirect arc electric furnace designed for iron, steel, brass, copper and nickel alloy. Detroit Electric Furnace Co., Detroit, Mich. (B 76)

Yoloy

A colorful bulletin summarizes the properties of the above alloy steel and lists the physical properties of two typical steels in the Yoloy series. Youngstown Sheet and Tube Co., Youngstown, O. (B 77)

Gas Fired Furnace

The manufacturer of the gas fired Lindberg Cyclone furnace for heating at temperatures from 250 deg. F. to 1400 deg. F. claims that the heating rate is remarkably fast. Lindberg Engineering Co., Chicago, Ill. (B 78)

Wet Patch

The manufacturer claims that excellent results are obtained when P. B. Sillimanite wet patch is used to patch crucible furnaces, electric furnaces, etc., because of its high refractoriness, negligible shrinkage and stubborn resistance to slag attack. The Chas. Taylor Sons Co., Cincinnati, O. (B 79)

Radium for Industrial Radiography

This article written by R. A. Gezelius and C. W. Briggs, containing interesting and important information on the subject, is published in handy booklet form. Radon Company, Inc., New York, N. Y. (B 80)

Ajax-Northrup Electric Furnaces

Bulletin No. 10, devoted to the oscillator or spark-gap type converters and furnaces supersedes Bulletin 7. General principles of this equipment are discussed. Illustrated. Ajax Electrothermic Corp., Trenton, N. J. (B 81)

MoTung High Speed Steel

An illustrated booklet devoted to the above, contains information under these divisions: working and treatment, surface protection, high heat temperatures, drawing temperatures, effect of treatments, etc. An index is included. Universal Steel Co., Bridgeville, Pa., and Cyclops Steel Co., Titusville, Pa. (B 82)

Heat and Corrosion Resistant Alloys Heated By Gas

Bulletin C1-A illustrates a number of complex castings made from Q-Alloys which are recommended for pipe fittings, furnace parts, etc. General Alloys Co., South Boston, Mass. (B 83)

Heat Exchanger

Bulletin No. 173 describes the Duriron heat exchanger which is available in the company's corrosion-resisting alloys—Duriron, Durichlor, Durimet, Durco Alloy Steel and Alcumite. Illustrated. Duriron Co., Dayton, O. (B 84)

Turbo-Compressor Data Book

This Data Book No. 107 was prepared to give accurate and brief information on the engineering characteristics of turbo

MANUFACTURERS' LITERATURE

blowers and exhausters. The Spencer Turbine Co., Hartford, Conn. (B 85)

The Jetal Process

Simple immersion in an aqueous bath for about 5 minutes colors all grades of common iron or steel a brilliant and uniform jet black. It is claimed it does not alter dimensions or articles and cannot chip, scale, peel or discolor. Alrose Chemical Co., Providence, R. I. (B 86)

Heavy-Duty Black

Triple-A No. 20 heavy-duty black is the full name of this coating for steel which, according to the manufacturer, resists acids, alkalies, brine, moisture, abrasion and sulphurous fumes. Quigley Co., Inc., New York, N. Y. (B 87)

A. W. 70-90

This bulletin describes the new high-strength "70-90" steel in sheets and plates. An article on the engineering aspects of high-strength sheet steels is included. Alan Wood Steel Co., Conshohocken, Pa. (B 88)

Ferrocarbo

This material containing both silicon and carbon combined in the form of silicon carbide acts as a graphitizer or softener when added to cast iron. Carborundum Co., Niagara Falls, N. Y. (B 89)

3300 Deg. Super Refractory

An illustrated catalog devoted to "Shamva" Mullite contains information regarding its background, characteristics and uses. Mullite Refractories Co., Shelton, Conn. (B 90)

Polishing Machines

A portable model and a floor model of these new metallographic machines are described and illustrated in a pamphlet from Eberbach & Son Co., Inc., Ann Arbor, Mich. (B 91)

Value of Draft Control

Bulletin No. L-125 is devoted to the above subject and points out the proper value of the furnace draft and this company's control which consists of a draft switch, a damper motor and a manual station. Illustrated. Shallcross Controls, Inc., Milwaukee, Wis. (B 92)

Fluxing, Deoxidizing and Hardening Alloys

Ajax alloys (phosphor copper, phosphor tin, nickel copper, manganese copper and silicon copper) are the subjects of a new leaflet issued by the Ajax Metal Co., Philadelphia, Pa. (B 93)

Stainless and Heat Resisting Electrodes

A colorful price list and data book containing complete descriptions of the company's products and also analyses of stainless and heat resisting alloys manufactured by other companies has been issued by Maurath, Inc., Cleveland, O. (B 94)

Cable Accessories

Publication GEA-1839 lists and describes the materials required for work involving the jointing and terminating of insulated cable. Illustrated. General Electric Company, Schenectady, N. Y. (B 95)

Cataloy Lead Bronze

This process which is guaranteed to perfectly combine copper and lead in your own plant is described in literature from Cataloy, Los Angeles, Cal. (B 96)

Duraloy

Chrome-nickel and chrome-iron alloy groups with recommended applications are listed in a new pamphlet from this company. Illustrated. Duraloy Company, Pittsburgh, Pa. (B 97)

Cor-Ten and Man-Ten

Pamphlet describing high-tensile steels developed to meet the needs of the transportation industry. United States Steel Corp., Pittsburgh, Pa. (B 98)

Dipping Baskets

If none of the 14 standard designs meets the customer's approval, this company will manufacture baskets to specifications. C. O. Jelliff Mfg. Corp., Southport, Conn. (B 99)

Dowmetal Data Book

A new edition of this book, containing especially significant accomplishments since the last data book, in the sections Available Forms and Shop Practice has been published by The Dow Chemical Co., Midland, Mich. (B 100)

Centrifugal Compressors

Bulletin 386 is devoted to this company's Design 9 Compressors. Illustrated. B. F. Sturtevant Co., Boston, Mass. (B 101)

Stainless Steel Castings

An attractive booklet contains useful information on the subject. Typical analyses, characteristics and suggested uses are listed. Joseph T. Ryerson & Son, Inc., Chicago, Ill. (B 102)

Brazing Alloys

The results of both laboratory and actual production data are contained in Bulletin No. 1 entitled "How to Use 'Handy' Silver Solders, Sil-Fos and Easy-Flo Brazing Alloys." Handy & Harman, New York, N. Y. (B 103)

Free Cutting Steel

An attractive booklet records fifteen years spent by the company's metallurgical department in research on the machinability of free cutting steels. Jones & Laughlin Steel Corp., Pittsburgh, Pa. (B 104)

Silicon-Chromium-Molybdenum Steels

A booklet devoted to Sicromo 1, 2, 3 and 5 steels, gives the analyses of the steels and discusses the effect of both silicon and chromium on the oxidation resistance of steels in which they are used. The Timken Steel & Tube Co., Canton, Ohio. (B 105)

Electric Heating Elements

A bulletin from this company is devoted to their electric heating elements and terminal accessories for industrial applications. Globar Div., Carborundum Co., Niagara Falls, N. Y. (B 106)

Dolomite Refractories

This interesting pamphlet presents the case of Clinkered vs. Calcined Dolomite in the basic open-hearth steel furnace. Basic-Dolomite, Inc., Cleveland, O. (B 107)

Drop Forging Topics

Interesting articles are included in this illustrated publication of the Drop Forging Association, Cleveland, O. (B 108)

Alloy Steels

A colorful folder devoted to these steels lists some of the advantages to be obtained by their use. Bliss & Laughlin, Inc., Harvey, Ill. (B 109)

Controlled Grain Anodes

Seymour Nickel Anodes are homogeneous in grain structure, according to this bulletin. The various available shapes are illustrated and some useful data are given. The Seymour Manufacturing Co., Seymour, Conn. (B 110)

Hi-Steel

Information concerning chemical composition, physical properties and corrosion resistance of this steel is offered by the Inland Steel Company, Chicago, Ill. (B 111)

Alloy Castings

Corrosion resistant and stainless steel castings are the subject of a new booklet. Chemical and metallurgical properties of these castings are included. Illustrated. Michiana Products Corp., Michigan City, Ind. (B 112)

Liquitol

Bulletin A1-16-A deals with the use of Liquitol for iron and steel castings and ingots. Alpha-Lux Co., Inc., New York, N. Y. (B 113)

Phosphor Bronze

A leaflet lists the sizes in which the company's twelve-inch stock bushing bars are now offered. The Phosphor-Bronze Smelting Co., Philadelphia, Pa. (B 114)

Konik

Data on this steel's physical properties, corrosion resistance and working are offered by the Continental Steel Corp., Kokomo, Ind. (B 115)

Titanium in Steel

The application of titanium in forgings, castings, rails, sheets and plates is described in a booklet devoted to the use of ferro-carbon-titanium in steel. Titanium Alloy Mfg. Co., Niagara Falls, N. Y. (B 116)

Lead

New methods for making lead pipe and lead sheet are announced by The Andrews Lead Co., Inc., Long Island City, N. Y. (B 117)

Manganese Steel Products

Bulletin R-1 which contains the statement that this company's rolled manganese steel follows precisely the "Hadfield Formula" also contains an alphabetic list of applications. Manganese Steel Forge Co., Philadelphia, Pa. (B 118)

Air Setting Bond for Firebrick

Wal-Set, for bonding firebrick and other refractory materials, is the subject of an illustrated pamphlet. It is claimed that after being subjected to heat Wal-Set literally welds the firebrick together. Wahl Refractory Products Co., Fremont, O. (B 119)

New Equipment and Materials

A Dust Counting Apparatus

The determination of dust concentration has been a technical engineering problem involving the use of special apparatus, but there are certain operations where it is safe to assume that dust concentrations are high unless somewhat elaborate precautions are being taken to prevent the formation or the inhalation of dust. Mining in hard rock, particularly when dry drilling is involved, cutting and polishing granite, grinding with sandstone wheels, sand blasting and sand pulverizing, are notoriously hazardous occupations. Silica hazards may also be present in foundries, potteries and paint manufacturing plants using silica.

Without definite knowledge of actual dust concentration it is impossible to work intelligently on dust control. With the collaboration of a great insurance company, Bausch & Lomb Optical Co., Rochester, N. Y., has developed a dust counter which will enable dust counts to be made easily and accurately without extensive laboratory training or experience by the operator. A foreman, engineer or chemist can be relied upon for accurate results. This instrument combines in one unit the necessary air sampling device and dark field microscope viewing and counting system, mounted on a circular base, provided with illuminating apparatus and suitably cased for transportation or storage.

In the Bausch & Lomb instrument air is drawn through a moistening chamber by means of an accurately calibrated hand pump of 1/1000 cu. ft. capacity. The dust particles suspended in the air are impinged on a circular glass plate within the instrument. The dust deposit is in the form of a ribbon. Twelve samples may be collected on one slide. These samples may be viewed and counted at once without removal and they may be preserved for future reference by simply sealing a cover glass to the slide.

The viewing and counting apparatus consists of a built-in compound microscope of 200 diameter magnification with a special dark field illuminating system. The special hyperplane eyepiece contains a micrometer disc ruled in 30 micron squares. An extra line, ruled next to the squares, permits approximate measurement of particles for classification as to size. The apparatus is so calibrated that, by multiplying the number of dust particles in the square fields by 100,000, the total dust count per cubic foot is secured.

The unit of dust measurement is the micron, one twenty-five thousandth of an inch. According to Dr. Robert Hunt, experimentation has proven that dust greater than 10 microns in diameter is practically harmless as far as the lungs are concerned, but the maximum amount of lung pathology may be expected from dust averaging between 2 and 5 microns. Such microscopic dust is, of course, invisible to the naked eye.

Among the industries in which dust control is important may be included: Foundries, steel, malleable, iron and non-ferrous; steel mills, including wire manufacturing; mines and quarries; tool manufacturing — processes of grinding and polishing; forge shops, jewelry, hardware and saw manufacturing; and all sand blasting processes for stone and metal.

Oxweld Announces Three New Regulators

A series of three new regulators providing accurate oxygen and acetylene regulation through the entire range of welding and cutting operations has just been announced by The Linde Air Products Co., 30 East 42nd Street, N. Y. All three regulators are of two-stage construction, essentially identical in basic design, and offer the utmost in precise, efficient pressure control.

The "Oxweld Type R-64" oxygen regulator is designed to operate with extreme precision in all welding and cutting operations requiring oxygen pressures up to 75 lb. per sq. in. The Oxweld Type R-65 oxygen regulator is designed for heavy-duty cutting operations, which may require oxygen pressures as high as 200 lb. per sq. in. As the sensitivity of adjustment and precision of operation carry throughout its entire pressure range, it can also be used for welding, should the need arise. The Oxweld Type R-66 acetylene regulator is a companion piece for either of the oxygen regulators and will give accurate acetylene regulation for all welding and cutting operations.

The attractive, streamlined appearance of these regulators gives visual evidence of the modern design principles that have been employed throughout in their construction.

There are several outstanding details of design which are of particular importance to anyone using welding and cutting apparatus. The valves are stem-operated and close with the incoming pressure, not against it. Sensitive rubber diaphragms and self-contained first stage valves are important improvements. The bodies and caps are pressure forged to insure adequate strength. The dials of the pressure gages are colored and the calibrations are silvered thus making them exceedingly easy to read. The point of the pressure-adjusting screw is cradled in three ball bearings to preserve exact alignment and provide fingertips regulation through its full range. The handle of the adjusting screw is tri-spoked to provide an effective grip for obtaining sensitive adjustment of the delivery pressure. The regulator bodies are finished with a durable lacquer, green being used for oxygen and red for acetylene.

New Enamel Produces Chemical Metal Colorings

The colors produced on metals by the anodic process and other chemical coloring methods can now be economically produced by a new line of enamels developed by Maas and Waldstein Co., Newark, N. J., according to a statement by that company.

This new type of enamel, known as "Platelustre", is semi-transparent and, when mixed with clear lacquers gives a clear, brilliant, transparent colored effect that is said to be fast to light and very durable. Platelustre is supplied in a large assortment of colors, permitting the reproduction of all popular chemical metal coloring effects as well as making possible new effects, without the use of chemical processes.

Metals of all kinds can be finished with Platelustre. It is especially suitable for compacts, lighting fixtures, novelties, casket hardware, and other products where a brilliant colored metallic finish is desired.

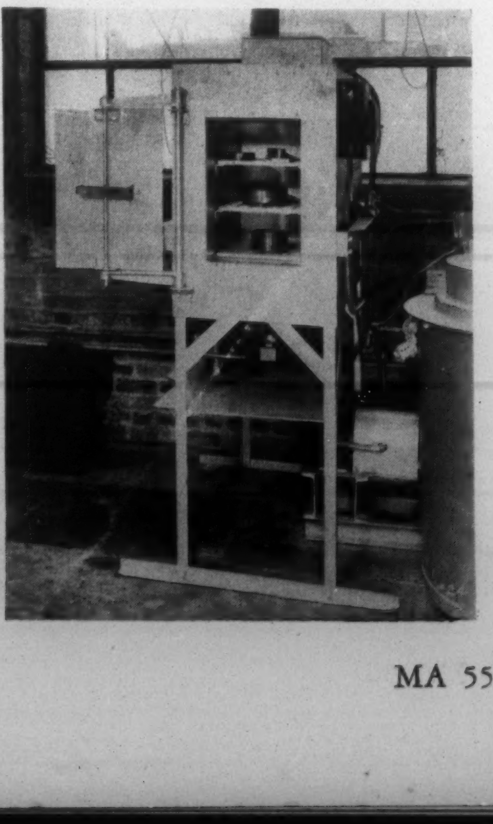
A Type Furnace for Toolroom Service

The Lindberg Engineering Co. announces a new addition to the line of "Cyclone" tempering furnaces for toolroom service. Although it has the same operating principle as the standard Cyclone, it is not a production furnace, but a box type unit that is recommended for use where the work is charged and removed, piece by piece.

The method of construction is similar to that of the production Cyclones. The air is driven by a powerful blower fan through the electric heating elements, and into the top of the work chamber, where it passes down through the charge and returns to the fan through a perforated metal bottom plate.

Several shelves are provided in the work chamber to hold small parts when tempering. These shelves can be removed when large parts are to be treated. The furnace door is of the plug type, and is specially hinged so that it can be readily withdrawn and swung away from the opening, the hot face of the door being always away from the operator.

These box type Cyclone furnaces are made in several sizes for applications in tempering either to 800 or to 1200 deg. F. They fulfill a real need in modern tool room practice by supplying a rapid and convenient method of tempering individual pieces or small group parts without resorting to expensive equipment.



Advancements in Refractories

Two patents covering an important advancement in refractories, have recently been allowed to the chief technologist, J. M. Knote, Quigley Co., New York, and assigned to the company. The first, U. S. patent No. 2,051,003, covers a refractory material and method of making same. It is a process of manufacture and mixture for brick and monolithic refractory linings for furnaces and like purposes. This new chrome-magnesite refractory is a further improvement on the invention of Bronn, U. S. No. 1,780,114 (Quigley Co., Inc.) and it has two distinct fields: First, as a substitute for the older types of basic brick either chrome or magnesite, and second, as a new refractory in places where silica and fire clay refractories had formerly been used; sometimes displaces silicon-carbide and other super-refractories.

The second covers a refractory composition and is U. S. patent No. 2,051,002. It is a composition for lining of furnaces and mixture for making same. This is a chromite-dolomite refractory and is a further improvement on Bronn, U. S. 1,780,114.

The Riehle "VV" Variable Velocity Impact Tester

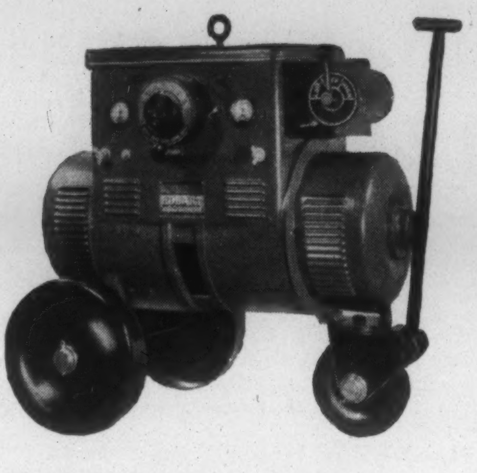
A variable velocity impact tester has been developed by H. C. Mann and Captain R. K. Haskell and is put on the market by the Riehle Division of the American Machine and Metals, Inc., 100 Sixth Avenue, New York.

In principle this machine, known as the Riehle "VV" variable velocity impact tester, consists of two entirely separate and distinct parts: the pendulum as a means for measuring the energy required to rupture the test specimen, and the rotatable wheel and related parts which serve to develop the necessary kinetic energy and velocity. These two systems have no interconnection or effect on each other except through the test specimen during the process of rupture.

The pendulum which acts as the energy measuring system, is normally at rest, and moves only as a result of the impulse imparted to it through the test specimen, which is attached to and acts only on the pendulum. All other parts of the machine including the wheel, horns, tup, etc., act merely to develop and transmit energy to the free end of specimen.

The wheel, mounted on a hollow shaft, encloses retractible horns and balancing counterweight positioned diametrically opposite, and which revolve outward on pins attached to the wheel. The horns and counterweight are held in the retractible position by an internal mechanism and controlled through the hollow shaft by an external tripping device, which at any desired velocity operates to release the horns and counterweight, permitting them to revolve outward due to centrifugal force.

In operation, the test specimens and tup are attached to the pendulum, and with the horns and counterweight retracted, the wheel is brought up to speed by means of a 10 h.p. motor. At the desired velocity, measured by means of a tachometer, the external mechanism is tripped, releasing the horns which revolve outward due to centrifugal force, striking the tup and thereby rupturing the test specimen. The angular movement produced in the pendulum is recorded on a special dial indicating gage, actuated by the rise of an eccentric cam attached to one side of the pendulum, this gage being graduated to read directly the value of $(1 - \cos \theta)$.



Current Saving Motor Control on 1937 Welders

A revolutionary new development in arc welding is announced by The Hobart Brothers Co., Troy, Ohio, manufacturers of Hobart "Simplified" arc welders. The new Hobart "Serial MN Current-Saving Models" embody (in addition to an improved type of wheel mounting with low center of gravity) what is termed as "Selective Motor HP Control". It is said that this is the first arc welding set equipped and with economical control of the motor as well as the generator.

Only one-third the usual starting current is required, the power factor of the machine and its efficiency are materially improved, and it is possible to use the equivalent of a motor on one-half the horsepower rating for welding in ranges up to one-half to two-thirds the rated capacity of the generator. The manufacturers' announcement claims that the results are (1) welding current costs are cut 30 to 50 per cent in average work, (2) power company penalties due to poor power factor of equipment are avoided, (3) expensive re-wiring of many plants is eliminated, and (4) idling and light load power losses are cut in half.

Automatic Combustion Control

Shallcross Controls, Inc., Milwaukee, Wis., has developed a system of automatic combustion control for metallurgical furnaces. It automatically proportions the air to the fuel in any furnace which is fired under manual control, that is, where the rate of firing is to be set from a manual control station. Such furnaces are—malleable, annealing, melting, billet, sheet—all metallurgical furnaces, soaking pits, open-hearths, glass furnaces, ceramic kilns, rotary retorts, etc. The control is applicable to either natural or forced draft furnaces, fired by a stoker or pulverizer, or by gas or oil.

This control consists of a combustion control Bulletin L-137 but without the steam pressure switch. In the Bulletin L-137 control, the motor in the master is actuated by a steam pressure switch, maintaining constant boiler steam pressure while in this L-142 control the master motor is actuated from a manual station, maintaining whatever rate of furnace firing is desired. The crank of the master motor is connected to that element of the fuel supply which controls the rate of fuel feed—to the feed mechanism of a stoker or the speed control of a stoker, to the feed of a pulverizer, or to the valve in a gas or oil line. This fuel feeding device must be such that the rate of fuel feed is proportional to the movement of the stoker or pulverizer feed lever, etc., gas or oil to the movement of their valve levers. A draft pipe is led from the furnace to the air control which latter actuates the stack damper motor.

As described in Bulletin L-137 the air control is so interconnected with the combustion control master motor that the draft maintained in the furnace is automatically varied with the rate of fuel supply as set from time to time on the manual station. This ratio of air to fuel is adjusted in the master control when the control is installed (principally from observations of the CO_2) and, when once so set, is never disturbed except when the kind or quality of the fuel is changed, the air rising and falling automatically with the fuel and in the fixed ratio to the fuel, under all rates of firing.

The control on a forced draft furnace is similar to that on natural draft, with three exceptions:

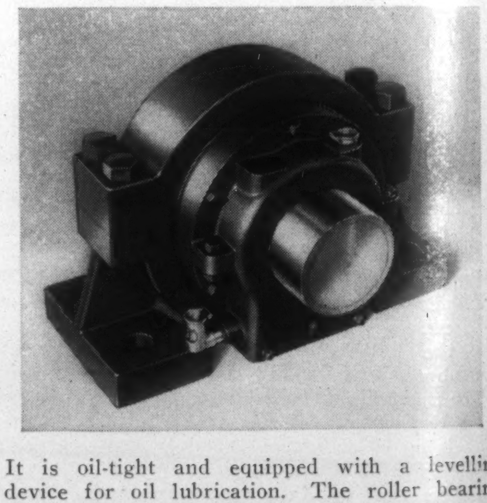
(1) The draft pipe to the air control now leads from an air measuring orifice at the fan inlet or, two pipes lead from an orifice plate in the air duct; (2) the air control now actuates a motor on an air duct damper or on a vortex louver on the fan inlet; (3) a furnace draft control, described in Bulletin L-125, is now desirable on the furnace.

The operation is exactly the same as on natural draft, the air being continuously proportioned in a fixed ratio to the fuel, the rate of firing being set from a manual control station. All parts are rugged and there are no delicate elements or parts which require attention. Adjustments are reduced to the minimum and, when these adjustments are made at the time of installation, they never need further attention. All parts are enclosed in completely dust tight cases, with removable inspection covers.

Ball Bearing Which Takes Thrust Loads

A special roller-bearing pillow block for service involving heavy end thrust in addition to the radial load is now being produced by the Fafnir Bearing Co., New Britain, Conn. In the new pillow block, a separate heavy-duty ball bearing to take the thrust loads is included as an integral part of the assembly. The design is said to be definitely superior in capacity and service life to that in which bronze plate thrust carriers are used.

Arrangement of the bearings is such that the entire radial load is taken by the roller-bearing, while all the forces tending to displace the shaft axially are borne by the ball-bearing. A spherical housing construction which provides self-alignment, similar to that used in other Fafnir roller-bearing pillow blocks, is also a feature of the design. The housing is of the two part type, which simplifies assembly.



It is oil-tight and equipped with a levelling device for oil lubrication. The roller bearing itself is of the special type recently developed in which an increased number of solid rolls are incorporated, thus giving the greatest possible load capacity. The cage is also said to be of unusually sturdy construction.

These pillow blocks are now available for shaft sizes ranging from $3\frac{5}{16}$ to 10 in., and with radial load capacities up to 250 tons.

Measuring Oil or Tar With the "Mir-o-Meter"

The Bowser "Mir-o-Meter" of S. F. Bowser & Co., Fort Wayne, Ind., is a system which measures, indicates and records the quantity of oil or tar being delivered to a furnace. In reality, it is a system that measures and records the amount of fuel consumed; and indicates and records the rate at which it is being delivered.

The fuel, on being pumped into the registering meter (where it is measured and recorded), causes the displacement rotor in the meter to revolve. The extended end of the shaft to which this rotor is fixed is direct-connected to the tachometer generator, which generates the low voltage electrical force that actuates the wall indicator dial, showing the rate at which the fuel is being fed to the furnace. To assure utmost accuracy and high efficiency, the generator is especially balanced at the factory to operate with the particular meter with which it is to be used.

An especially important feature is the ease and flexibility of its installation. The meter and generator can be installed wherever desired, and the indicator and the indicator-recorder each placed at points up to 750 ft. from the generator. For convenience, it is usually best to install the indicator near the furnace and the indicator-recorder in the superintendent's office or at any other desirable or convenient point.

The Mir-o-meter system, by assuring constant accuracy in measurement and indication, permits a close check to be kept on fuel consumption and burner efficiency. It not only provides an effective means of determining the quantity of fuel required for maximum efficiency, but also an accurate means of knowing at any time just what amount is being delivered to the furnace. By constantly using just the correct quantity of fuel, more even heats can be maintained without excessive consumption. The savings in fuel consumption may in some cases be as much as 5 to 10 per cent.

The standard system consists of a Bowser Fig. 760 registering meter direct-connected to a high quality, accurate tachometer generator, and mounted on a substantial base, also a wide vision, efficient indicator actuated by the generator. When desired, a high quality combination indicator and penwriting recorder can be furnished at extra cost.

Alrose Wite-Brass Plate

The Alrose Chemical Co., Providence, R. I., creator of the "Jetal Black Process" for steel and iron, is now marketing a "white brass" plating solution under the trade name "Wite-Brass." This is claimed to be as white as silver, non-tarnishing and extremely simple to control.

The Wite-Brass process is inexpensive to install. A steel tank is used to hold the solution and also serves as anode. The only cost is that of the chemicals for the solution, which is less than 20c per gal. The bath operates at a temperature of 140 to 175 deg. F. at a current density of 25 amps. per sq. ft. No after-buffing of plated work is required. A mirror finish is obtained on polished work when plated for as much as 2 hrs.

In spite of the fact that Wite-Brass is an alloy plate of three metals, it presents practically no difficulty in control and is easier to maintain than an ordinary brass solution. Wite-Brass deposits at the same rate as an ordinary nickel solution.

The company feels that this solution fills a long-felt need in the plating industry. The advantages of its white, silvery color, non-tarnishing properties and precious metal appearance should recommend it to all platers. It can be plated over any metal surface and is suitable for all types of metal novelties, flatwear, optical goods, reflectors, metal stampings, and, in fact, wherever nickel or silver is applied.

Binder for Lead and Copper

In Los Angeles during the past several weeks considerable interest is being manifest in a new alloy for combining lead and copper into high-lead bronze. Several industrial firms have written the manufacturers of the alloy, to be known to the trade as "Cataloy," expressing high degree of satisfaction with the performance of this new metal.

When Cataloy is processed with lead and copper, a silky, fine grained high-lead bronze results which can be poured and repoured into bearing metal repeatedly without any sacrifice of quality or segregation of any of the metals employed. The manufacturers claim that no lead "spots" will develop, and in cases where tin is used in bearings the tin content can be considerably reduced, thus saving many dollars to bearing users.

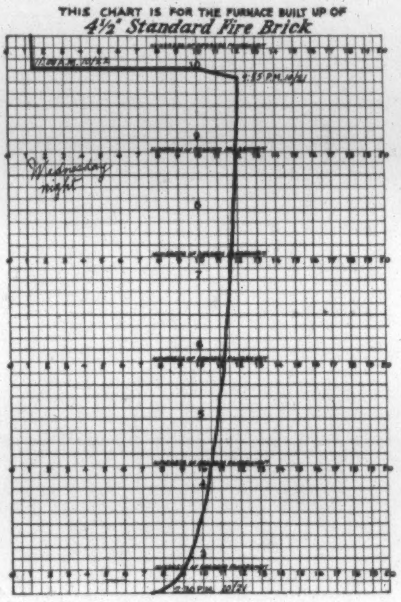
Scientific Alloys, Inc., of Los Angeles, manufacturers of this new metal have been developing and perfecting Cataloy over a period of some 5 yrs., conducting extensive laboratory tests as well as in industrial plants, large and small. They offer a generous trial sample for $2 on a money-back guarantee.

AT THE CLEVELAND STEEL SHOW

COMPARATIVE TESTS IN DEMONSTRATION FURNACES PROVE EFFICIENCY OF

Armstrong's EF-26 *Insulating Fire Brick*

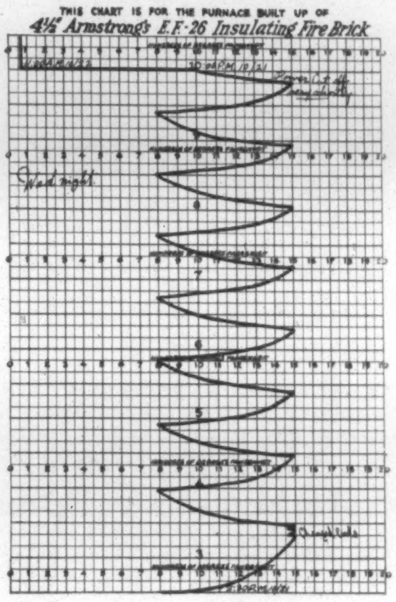
THIS CHART IS FOR THE FURNACE BUILT UP OF
4½" Standard Fire Brick



Charts at the left and right were simultaneously recorded on Brown Instrument Company's potentiometers. Burners were Surface Combustion atmospheric type, of exactly the same size and type, and similarly adjusted by their engineer.

FURNACES BUILT WITH *Armstrong's* **BRICK**

THIS CHART IS FOR THE FURNACE BUILT UP OF
4½" Armstrong's E.F.-26 Insulating Fire Brick



. . . give Quicker Heating, Lower Fuel Consumption, Lower Heat Storage, Increased Production, Lower Outside Furnace Temperatures, Greater Operating Flexibility

At Cleveland, two furnaces were set up. One was constructed of 4½" standard fire brick; the other, of 4½" Armstrong's EF-26 Insulating Fire Brick. The purpose of the test was to give an accurate comparison—not to establish any records. Therefore, no coatings were used on the outside or the inside of either furnace.

Now follow the charts, and you'll see that with the gas supply the same, the fire brick furnace required from 2:30 P.M. until 9:55 P.M. to rise from 750° to 1210°. During the same length of time, the furnace insulated with Armstrong's EF-26 Insulating Fire Brick was brought up to 1500°, and allowed to cool off to 800°, a total of EIGHT TIMES.

Convincing tests—even under unfavorable show conditions. Far more convincing, however, is the performance record of Armstrong's EF-26 Insulating Fire Brick *under actual working conditions.* These efficient brick can be made up in any special sizes—machined to size with a tolerance of 4/1,000 of an inch, or cast to size with a tolerance of 1/16 of an inch. Write for complete information and samples . . . also your copy of our new illustrated folder. Armstrong Cork Products Company, Building Materials Division, 982 Concord Street, Lancaster, Pennsylvania.

Armstrong's

HIGH TEMPERATURE INSULATION

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